

THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
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National Metal Week

A Report of the Meetings of the Institute of Metals Division in Conjunction With Other Societies in Chicago, Ill., September 22-26, 1930. Large and Varied Exhibition Shown of Metal Working Equipment and Supplies.

THE National Metal Congress and Exposition was held in Chicago, Ill., September 22-26, at the Stevens Hotel. This Congress, which is sponsored every year by the American Society for Steel Treating, was held in co-operation with a number of other technical societies, among which was the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers. The Institute of Metals held a series of meetings at which a regular program of technical papers was presented. Abstracts of papers begin on page 461.

In addition the exposition showed metal working machinery of all descriptions. Among those exhibitors specializing in non-ferrous metals were the following:

Ajax Electrothermic Corporation, Trenton, N. J. A 1,000-lb. Ajax-Northrup coreless high frequency induction furnace, and photographs showing installations of

such furnaces and the equipment necessary for operating them.

Aluminum Company of America, Pittsburgh, Pa. Aluminum in all commercial forms.

American Brass Company, Waterbury, Conn. Anaconda non-ferrous welding rods. Featuring Tobin bronze and Everdur welding rods. Samples of cast iron pieces welded with Tobin bronze. Display of Everdur metal—a copper-rich alloy, containing manganese and silicon, with the strength of mild steel. The proper methods used in welding with Tobin bronze filler rods and the oxy-acetylene process.

American Gas Association, New York.

American Gas Furnace Company, Elizabeth, N. J. Gas Section. No. 1 rotary retort brass melting machine; capacity 200 pounds of brass. No. 116 insulated tool

Officers of the Institute of Metals Division



SAM TOUR
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Secretary-Treasurer

room oven furnace; No. 131 insulated tool room oven furnace; small equipment, including No. 3 regular melter which may be used for making coal ash tests; cylindrical furnace with dilatometer, tool room forge, muffle furnace, also bench appliances such as soldering iron heaters, soft metal furnace, blowpipes and burners; heating machines and furnaces are all equipped with the American Gas Furnace Company automatic temperature controllers and flow meters.

Armstrong Cork and Insulation Company, Lancaster, Pa. Armstrong's insulating brick; Nonpareil insulating brick; Armstrong's cork covering; Armstrong's corkboard roof insulation; Armstrong's high-pressure covering.

Bausch and Lomb Optical Company, Rochester, N. Y. Microscopes, specially designed for use in the metal treating industry, photomicrographic apparatus, colorimeters, tool makers' microscopes, metallographic equipment, magnifiers, reading glasses and numerous other optical instruments.

Botfield Refractories Company, Philadelphia, Pa. Refractories, cements and mixtures.

Bristol Company, Waterbury, Conn. Automatic control equipment, comprising pyrometers and thermometers, recording and controlling complete equipment for heat treating furnaces, oil baths, enameling ovens, core ovens, etc., including all types of electric and air operated controllers. Also Bristol set screws and cap screws, specially heat treated.

Brown Instrument Company, Philadelphia, Pa. A full line of instruments for measuring and controlling furnace temperatures and other operating factors in metal working; a central feature is a display of Brown automatic control pyrometer equipment; also a Brown model 801 indicator and the Brown trend-analyzing record; other features include recording thermometers; Brown electric flow meters; tachometers; CO₂ meters.

Calorizing Company, Wilkesburg, Pa.

Carborundum Company, Niagara Falls, N. Y. Carborundum and Aloxite brand grinding wheels for all grinding purposes, Aloxite brand Redmanol superspeed snagging wheels, Carborundum brand green grit wheels for grinding tungsten carbide, Carborundum and Aloxite brand polishing grains, Aloxite brand cloth.

Corhart Refractories Company, Inc., Louisville, Ky. Refractory shapes on tables with simple demonstrations of the properties of the material, also service photographs.

Driver-Harris Company, Harrison, N. J. Heat treating containers and furnace parts made of Nichrome, heat-resisting alloy; pyrometer protection tubes; dipping baskets; trays, rollers, fixtures and other furnace parts; bolts and nuts; retorts, mufflers and small intricate castings.

Duriron Company, Dayton, Ohio. Duriron and Durimet acid-resisting pumps, exhaust fans, valves, tank rods, steam jets and Durimet welded pickling tank.

J. B. Ford Company, Wyandotte, Mich. Glass tanks showing methods for agitating metal cleaning solutions by air; samples of metal cleaners.

General Alloys Company, Boston, Mass. Nickel chrome alloys, "Q Alloys"; miscellaneous furnace parts; parts for every type heat treating furnace.

General Electric Company, Schenectady, N. Y. Box type heat treating furnace; air-draw furnace (vertical cylindrical type) air-draw oven (box type); melting pot for white metals; lead hardening furnace (vertical cylindrical type); samples of copper brazed steel parts; portable Battledock floor welded and control; atomic hydrogen arc

welding equipment for hand welding; automatic atomic hydrogen arc welding equipment; portable semi-automatic welding equipment; ammonia dissociators; 500 ampere multiple-operator constant-potential arc welding set; General Electric Company welding electrodes.

General Spring Bumper Corporation (Division of Houdaille-Hershey Corporation), Detroit, Mich. Polishing wheel set-up machine as substituted for old method of hand set-up.

Gordon Company, Claud S., Chicago, Ill. Pyrometer accessories, including thermocouples, switches, lead wire, protecting tubes, insulators and other accessories of a special nature and design for regular and special application.

Hauck Manufacturing Company, Brooklyn, N. Y. New Hauck Micro-Vernier oil regulating valves in four sizes; the new Hauck Venturi type atomizing low pressure oil burners in four sizes.

Illinois Testing Laboratories, Inc., Chicago, Ill. Stationary and portable indicating pyrometers for heat treating furnaces, draw furnaces and metal baths and general use; portable Pyro Lance for measuring the temperature of molten non-ferrous metal; portable Thermo Lance for annealing ovens and furnaces; thermocouples; pyrometer accessories.

International Nickel Company, Inc., New York. Typical examples of industrial applications of nickel and nickel alloys; members of development and research were in attendance to discuss the production or application of these products.

Charles F. Kenworthy, Inc., Waterbury, Conn.

Madison-Kipp Corporation, Madison, Wis. A new size automatic die casting machine; also Kipp air grinders and accessories.

Maehler Company, Paul, Chicago, Ill. Gas Section. Maehler universal gas-fired direct connection heater for tempering, drawing, normalizing, mold and core baking; Maehler electrical control cabinet and automatic temperature and safety controls.

Maxon Premix Burner Company, Muncie, Ind. Gas Section. Industrial fuel burning equipment consisting of blower type gas burners, inspirating type gas burners, motor-driven automatic control valves and solenoid safety valve.

New Jersey Zinc Company, New York. A variety of finished products made principally of die cast parts, besides an exhibit of unassembled die castings; this exhibit of assembled products including several in operation, illustrated the variety of finishes in which parts die cast of alloys of high grade zinc are now produced.

Norton Company, Worcester, Mass. Alundum grinding wheels; Crystolon grinding wheels; Norton refractories.

Roessler and Hasslacher Chemical Company, New York. Complete line of chemicals used in the electroplating of metals; demonstration of electroplating of copper, cadmium and zinc on steel; samples illustrating the application of electroplating and heat treatment of steel.

Surface Combustion Company, Inc., Toledo, Ohio. Gas Section.

Trent Company, Harold E., Philadelphia, Pa.

Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. Portable, 200 and 400 amp. Flex-Arc, single operator welding units; automatic seam welder equipped with Weldomatic head to demonstrate automatic welding of longitudinal seams; the 200 and 400 amp., single operator units used to demonstrate Flex-Arc welding electrodes; also views of electric furnace installations in the metal industry.

Abstracts of Non-Ferrous Papers

INFLUENCE OF CASTING PRACTICE ON PHYSICAL PROPERTIES OF DIE CASTINGS

BY CHARLES PACK

It has been the prevailing belief that the physical properties of die castings are dependent entirely upon the composition of the alloy used. Deviations in the physical



CHARLES PACK

properties of die castings have been promptly attributed to alloy variations and it has been rather difficult for the plant metallurgist to enlist the cooperation of those responsible for machine and die design, in his efforts to produce die castings of better physical properties. The writer hopes that by this paper he will have helped to emphasize the fact that the production of good die casting that will meet maximum physical requirements is not entirely within the control of the plant metallurgist, but that this responsibility must be shared equally by the mechanical and metallurgical divisions of the plant.

The present die-casting industry has been built upon the principle that the mechanical phase was predominant. Mechanics designed the die-casting machine and the die for use with the machine, leaving it to the metallurgist to provide suitable alloys. Under these conditions, the metallurgist was greatly limited in his choice of alloys. The writer is pleased to record a growing tendency to recognize the importance of the metallurgical phase of the industry in designing die-casting machines. Future development of die-casting equipment may be expected to comply with good metallurgical practice.

CONSTITUENTS OF ALUMINUM-IRON-SILICON ALLOYS

BY WILLIAM L. FINK AND KENT R. VAN HORN

Aluminum forms not only binary compounds with most of the metallic elements but also forms many ternary or more complex constituents. Several of those occurring in the more important alloy systems have been identified under the microscope and the action of various etching reagents has been carefully studied. The determination of the structure and composition of these complex constituents is a matter of some difficulty and little information is available.

X-ray crystal analysis offers a promising method for the study of such constituents. First, and of considerable importance, is the possibility of recognizing the presence of a given constituent by means more positive than microscopic observation. Evidence can also be obtained concerning the nature and composition of the constituent in question and ultimately it should be possible, at least in some cases, to describe the structure including the relative locations of the various atoms.

In this paper some results of an uncompleted study of the constituents of the aluminum-iron-silicon system are given and the methods employed are described.

APPLICATION OF X-RAYS TO DEVELOPMENT PROBLEMS CONNECTED WITH THE MANUFACTURE OF TELEPHONE APPARATUS

BY M. BAEYERTZ

From these examples, it is evident that the use of X-rays makes possible the study of features of metals and alloys in a way not possible by other metallographic methods. In radiography X-rays are used to integrate solid sections in one plane, or, aided by the stereoscope, to see the extent and direction of defects in three dimensions. This gives more knowledge than the usual method of sectioning and etching in the study of such features as gas bubbles, shrinks, cracks and other discontinuities. At present, however, the cost is prohibitive except in development work or unless the engineering requirements for the casting or forging are unusual.

STUDIES UPON THE WIDMANSTATTEN STRUCTURE, I.—INTRODUCTION. THE ALUMINUM-SILVER SYSTEM AND THE COPPER-SILICON SYSTEM

BY ROBERT F. MEHL AND CHARLES S. BARRETT

1. Previous studies on the structures originating in a precipitation from a solid solution—Widmanstätten structures and figures—have been reviewed and critically discussed, particularly from the theoretical point of view. The object of the present study is an understanding of the mechanism of formation of segregates from solid solutions.

2. The precipitation of the γ phase from the δ solid solution in the Al-Ag system has been subjected to experimental study, and it has been found that the γ phase forms plates parallel to the (111) or octahedral planes in the original face-centered cubic δ solid solution. By a suitable study of fiber structures in the drawn and subsequently heat-treated δ solid solution it has been shown that the basal plane (00.1) in the hexagonal γ phase forms parallel to the octahedral plane (111) in the face-centered cubic δ phase.

3. A study of the precipitation of the γ phase from the α Cu-Si solid solution has been made. It was found that this phase precipitates in the form of plates parallel to some crystallographic plane in the face-centered cubic α solid solution possessing 12 families of crystallographic equivalent planes. Although this plane was not identified, it is shown that it cannot be the plane of densest atomic packing, which is the (111) plane. The significance of this with respect to a previous generalization by Osmond and Cartaud is pointed out.

4. It is suggested that the Widmanstätten figure need not always consist of plates, for true needles and other forms sometimes occur. In every case, however, the orientation of these forms is controlled in part by the orientation of the parent solid solution lattice.

5. It is tentatively proposed that a new phase appearing by precipitation from a solid solution does so in such a way that some crystallographic feature in the lattice of the precipitate forms directly with a minimum shift of atoms from a nearly identical crystallographic feature in the parent solid solution lattice. Such a theory does not require that the new phase appear as plates parallel to the plane of densest atomic packing in the original solid solution lattice and is in better accord with the experimental data here presented than previous theories.

A picture of the atomic kinetics of such a process is presented.

EQUILIBRIUM RELATIONS IN ALUMINUM-ANTIMONY ALLOYS OF HIGH PURITY

By E. H. DIX, JR., F. KELLER AND L. A. WILLEY

The consideration of alloying elements for aluminum has led to a series of investigations of the equilibrium relations between aluminum and those alloying elements. Therefore, the aluminum end of the aluminum-antimony diagram has been studied.

It has been the purpose of this investigation to determine the solid solubility of antimony in aluminum and also to investigate the eutectic temperature and concentration.

The solid solubility is less than 0.10 per cent at temperatures as high as 645° C. The eutectic concentration lies at about 1.1 per cent antimony and the eutectic temperature at 657° C.

CEMENTED TUNGSTEN CARBIDE.—A STUDY OF THE ACTION OF THE CEMENTING MATERIAL

By L. L. WYMAN AND F. C. KELLEY

In order to clarify and amplify the existing data concerning the action of the cementing material in cemented tungsten carbide alloys, the authors have initiated this investigation of the entire range of cobalt-tungsten carbide alloys. Inasmuch as the ultimate objective is relative to what actually goes on during the sintering of cemented tungsten carbide materials, this work was necessarily restricted to heat treatments similar to those used in actual production of these materials. In the course of numerous experiments, the authors have noted several conditions that indicated that there was a solubility to be considered.

The authors at present are of the opinion that the binding constituent in the cemented tungsten carbide materials usually reaches the liquid state during the final sintering operation, at which time it consists of tungsten carbide dissolved in cobalt. It is believed that upon solidifying this cobalt-rich cementing material remains as a solid solution of tungsten carbide in cobalt.

THERMAL CONDUCTIVITY OF COPPER ALLOYS II.—COPPER TIN ALLOYS

III.—COPPER-PHOSPHORUS ALLOYS

By CYRIL STANLEY SMITH

This paper is a continuation of the work on the thermal conductivity of copper alloys described in the author's previous paper. The thermal conductivity of copper (0.941 cal./sq. cm./cm./sec./° C.) is rapidly reduced by the addition of tin until with 10.41 per cent tin it is only 0.121 cal./sq. cm./cm./sec./° C. at 20°C. Phosphorus is 10 times as powerful as tin, as little as 0.93 per cent phosphorus reducing the conductivity to 0.129 cal./sq. cm./cm./sec./° C. The electrical conductivity decreases more rapidly on alloying than does the thermal conductivity, and the Wiedemann-Franz-Lorenz ratio increases rapidly at first, but beyond 2.0 per cent tin or 0.15 per cent phosphorus remains almost constant. This break in the Wiedemann-Franz-Lorenz ratio curve has occurred in every system yet examined and is evidently of basic physical significance.

EQUILIBRIUM RELATIONS IN ALUMINUM-MAGNESIUM SILICIDE ALLOYS OF HIGH PURITY

By E. H. DIX, JR., F. KELLER AND R. W. GRAHAM

Aluminum alloys containing relatively small amounts of magnesium and silicon are of commercial interest because they are readily workable in the annealed form and may be hardened and strengthened by suitable heat treatment. An intermediate temper can be produced in these alloys by quenching after a solution heat treatment and the alloy

in this condition can be formed easily. Artificial aging is required to obtain the maximum mechanical properties but this aging does not cause distortion nor require elaborate heat-treating equipment.

The hardening of the alloys after quenching is attributable in part to the retention of the compound Mg_2Si in solid solution, while the maximum hardness obtained by subsequent artificial aging is attributed to the fact that the solid solubility of the compound Mg_2Si in aluminum decreases with decreasing temperature.

Considering the importance of aluminum alloys susceptible to heat treatment, it is surprising how few fundamental investigations have been carried out on the aluminum-magnesium silicide alloys.

This paper deals principally with the solid solubility relations of the compound Mg_2Si in aluminum and is the sixth paper of a series from the laboratories of the Aluminum Co. of America reporting the results of investigations of equilibrium relations in aluminum-base alloys made from high-purity aluminum.

MODULUS OF ELASTICITY OF ALUMINUM ALLOYS

By R. L. TEMPLIN AND D. A. PAUL

When the number of alloy systems to be investigated is considered together with the effects of different variables within each of these systems, the magnitude of the modulus problem is evident. The present investigation is of a preliminary nature but the authors believe that the results contained in this paper are valuable because they furnish a general idea of the variation of E produced by the addition of the more common alloying elements to aluminum. The following conclusions seem predominant:

1. A general increase of modulus of elasticity results with the addition of iron, silicon, copper, nickel or manganese to aluminum.

2. In certain of the commercial aluminum alloys the modulus of elasticity is increased as much as 20 to 30 per cent by the presence of considerable amounts of the metals mentioned above.

3. The results obtained indicate that copper, iron and nickel produce changes somewhat in the order of their respective modulus values, nickel having the greatest effect and copper the least.

4. The addition of silicon to aluminum results in an increase of modulus without any increase in the density of the metal.

5. In heat-treated aluminum-magnesium alloys the modulus of elasticity does not decrease until magnesium is present in amounts greater than about 12 per cent; in alloys that have not been heat-treated the decrease occurs in the region between 6 and 10 per cent magnesium.

6. It may be concluded from paragraph 5 that magnesium held in solid solution in aluminum does not have as great an influence on the modulus of elasticity as when it is present as a free constituent.

EFFECT OF CERTAIN ALLOYING ELEMENTS ON STRUCTURE AND HARDNESS OF ALUMINUM BRONZE

By SELMA F. HERMANN AND FRANK T. SISCO

For the past century, the so-called aluminum bronzes have been assuming a role of ever-increasing importance in the metallurgical field. The last quarter of that century has marked many efforts to find alloying elements that would alleviate some of the undesirable qualities of the aluminum bronzes—for example, the heterogeneity of the alpha solid solution and the extreme hardness of the beta. Much of this work, however, has been rather haphazard—compositions and heat treatment are usually so much at variance as to make comparison impossible.

It is the object of this research to study the effect of certain percentages of common alloying elements on aluminum bronzes of analogous compositions and heat treatments. It is hoped that the material gathered here will at least serve as a basis for further systematic study.

ALUMINUM-SILICON-MAGNESIUM CASTING ALLOYS

By R. S. ARCHER AND L. W. KEMPF

Although many of the alloy compositions described in this paper have useful properties in the as-cast condition, it was the particular object of this investigation to find alloys suitable for the



R. S. ARCHER

production of heat-treated castings capable of withstanding severe service. In 1921, heat-treated aluminum-alloy castings containing 4 per cent copper were introduced commercially. The production of these castings has attained a considerable volume and in many fields of application the product has shown ability to withstand the type of service generally described as "severe." These castings are now manufactured to specifications requiring a minimum

tensile strength of 29,000 lb. per sq. in. with a minimum

elongation of 6 per cent, in the naturally aged condition, while higher strength with less elongation is produced by precipitation heat treatment. Tensile properties do not, of course, completely describe the fitness of a material for all kinds of service but at least they furnish a good indication. It is interesting, therefore, to note that strength and elongation similar to those of the commercial heat-treated 4 per cent copper alloy castings have been obtained, on a laboratory scale, with some of the aluminum-silicon-magnesium alloys described. Values that can be maintained in commercial production remain to be determined, but it seems that properties close to those mentioned can be obtained in such production.

Assuming that the mechanical properties of the heat-treated aluminum-silicon-magnesium alloy castings are similar to those of the heat-treated 4 per cent copper alloy, it is of further interest to compare the other characteristics of the materials. The machinability of the aluminum-copper alloy is somewhat better than that of the aluminum-silicon-magnesium alloys. The latter, however, can be commercially machined with standard tool set-ups, and with adaptation of tools and machining methods to suit the material can perhaps be machined as well as the aluminum-copper alloy.

Perhaps the chief advantage of the aluminum-silicon-magnesium alloys lies in superior foundry characteristics, including ease of casting and relative insensitivity to high pouring temperature. Corrosion resistance is higher than that of the 4 per cent copper alloy, especially when the iron content is kept low and no precipitation heat treatment is used. Specific gravity and thermal expansivity are lower than in the aluminum-copper alloys. Electrical and thermal conductivity are high in the aluminum-silicon-magnesium alloys, and although reduced somewhat by the small additions of copper, are probably still higher than in most commercial aluminum alloys.

Medal to Zay Jeffries

Zay Jeffries, chairman of the Institute of Metals Division, was awarded the Past Presidents' Medal as a token of appreciation for his work in the interest in the work of the American Society for Steel Treating.

Metal Congress at Boston in 1931

The next National Metal Congress will be held at the new Statler Hotel, Boston, Mass., from September 21st to 25th, 1931, it was announced at the end of this year's sessions. The annual exposition held conjointly will be housed in the Commonwealth Pier at Boston.

Attendance at this year's Congress at Chicago was believed to have exceeded the 58,000 recorded in 1929. The exhibitors had in all 80,000 square feet of space.

H. J. French Gets Howe Medal

Herbert J. French of the International Nickel Company, Bayonne, N. J., was awarded the Henry M. Howe Gold Medal, which is presented annually for the best technical paper published in the transactions of the American Society for Steel Treating. The paper was entitled "A Study of the Quenching of Steels."

Plating Small Holes

Q.—We have a peculiar problem which may be solved by plating. A spray nozzle is now produced from brass with an orifice drilled .02" drilled for a depth of about .05". The plate is somewhat thicker, but one side is cut away to a taper of about 135°, so that the depth is as stated. These nozzles wear very fast where water contains any amount of silt. We can go to a steel plate, but only at added cost, and with the likelihood of rusting. We can go to stainless steel, but that is almost impossible to drill or punch to the diameter needed.

It occurs to us that the answer may lie in tungsten plating, providing it is possible to get any deposit of tungsten on the wall of the hole.

We would not care how much deposit is built up outside the hole, providing a surface coating of any appreciable depth is actually deposited on the .02 diameter.

A.—I would suggest that a nozzle made of hard rubber would withstand the wear you refer to better than one made of metal. Experience with hard rubber has shown that this material is at least four times as resistant to abrasion as metal.

There is no plated deposit which will throw in the small holes and give a hard resistant surface. Tungsten plating which you mention, is not practiced in the industry, having only been done experimentally, and giving a coating which is very soft and entirely unsatisfactory for your purpose. You undoubtedly were thinking of chromium plating which gives a hard bright lustrous and resistant deposit. Unfortunately this metal cannot be plated successfully in very small holes such as you are dealing with and we would not recommend its use.

A. K. G.

White Metals, Brasses and Bronzes

A Series of Articles Describing the Types, Constituents, Properties and Methods of Making a Wide Variety of Mixtures as Practiced in a Large Casting Plant—Part 7*

By E. PERRY

Consulting Chemist, Oakland, Cal.

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

White Brass and Bronze

WHITE brass and bronze alloys are usually very hard, and many of them are extremely brittle.

The color of these alloys may range from white to creamy-white, and into gray. In melting, the least volatile metal is melted first, or in the case of two or more non-volatile metals like copper, iron, manganese, etc., they are melted together. Lead, antimony, tin, and zinc are generally added last and in the order named. White alloys containing a notable amount of copper are classed as white brass or bronze, but with little or no copper they are classed as "white metal."

The following table shows typical mixtures of the so-called "white brasses":

so it is advisable to cast such alloys in chilled iron molds to insure a homogeneous mixture.

White Metal Alloys (No Copper)

The white metals proper are made without copper and usually have a color approaching that of the metals used in the alloy viz.: of aluminum, antimony, bismuth, lead, tin, and zinc. In melting the metals without copper present, it is necessary to proceed in a different manner from the theoretical idea of melting the high-melting point metals first, except in the case of aluminum. In the aluminum mixtures the aluminum is melted first, then the zinc is fed in gradually, and the tin added just before pouring. One

Typical "White Brass" Mixtures

	Copper	Zinc	Tin	Lead	Antimony	Other metals
Soft white bronze	10.00	80.00	10.00	....	....	....
Hard white bronze	45.00	55.00	....	....	....	....
Chinese white bronze	72.50	4.30	4.70	18.50	....	....
Gray-white metal	40.00	60.00	....	....	....	....
Bluish-white metal	25.00	....	75.00	....	....	....
Bluish-gray metal	25.00	75.00	....	....	....	....
Pink-gray metal	42.50	57.50	....	....	....	....
White iron-bronze	10.00	80.00	....	....	....	10.00 Fe.
*Anti-friction metal packing	12.00	....	....	80.00	8.00	....
*Super-hard casting lead	16.67	....	....	75.00	8.33	....
Rigid aluminum	3.00	27.00	....	....	....	70.00 Al.
Zinc-bronze bearings	4.20	66.50	29.30	....	....	....
White metal for letters	7.40	7.40	28.40	....	56.80	....
White phosphor-bronze	1.00	....	....	72.00	12.00	15.00 P.-Sn.
Britannia metal	3.60	1.40	85.00	....	5.00	5.00 Bi.
Fine casting alloy	1.00	79.00	....	....	....	20.00 Fe.-Zn.
Bell Metals:—						
Standard bell metal	78.00	....	22.00	....	....	....
Sleigh bells	84.00	....	16.00	....	....	....
Ship bells	82.00	6.00	12.00	....	....	....
Railway bells	60.00	36.00	....	....	....	4.00 Fe.
Locomotive whistles	80.00	....	18.00	....	....	2.00 Sb.
Silver bell alloy	71.00	1.80	26.00	....	....	1.20 Fe.

Al is the symbol for aluminum; Bi stands for bismuth; Fe for iron; P-Sn for phosphor-tin; Sb for antimony; and Fe-Zn stands for ferro-zinc which contains 5.00 per cent of iron.

It will be noticed that some of the hard white alloys are made up of copper, zinc, and lead without addition of tin, for instance (*) indicated. Lead does not alloy well with either copper or zinc, nor with aluminum; therefore, unless tin is present segregation occurs and the lead sinks to the bottom. When antimony, which alloys readily with lead and copper, is present there is less segregation of lead, but even

or two ounces of dry zinc chloride are sprinkled on the surface of the molten aluminum as a flux previous to adding the metallic zinc. When the alloy is to be composed of lead, antimony, and tin, the lead is melted first and run to a red-heat, covered with charcoal, and the antimony then dropped in and allowed to dissolve. The crucible is then pulled from the fire and the tin put in and well stirred. It is almost impossible to melt the antimony alone, even if covered with charcoal, therefore, in a tin mixture without lead present, melt the tin first, cover with charcoal and soda, run the temperature up, and feed in the antimony in small portions. Arsenic and bismuth unite readily with lead and are usually added

*Parts 1 to 6 appeared in our issues of September, November and December, 1929, and February, May and August, 1930, respectively.

to the molten lead just before pouring, because arsenic is decidedly volatile and bismuth somewhat so. Cadmium unites best with zinc, and as both of these metals are quite volatile at a high temperature, they are generally added last.

The white metals are used for patterns, letters, ornaments, dishes, type-metal, toys, etc. Some examples of these are shown by formulas in the table below.

Pattern metals are generally cast in sand molds, but type metal is invariably cast in iron molds, while some of the low melting point white alloys are frequently cast in plaster or Paris molds. Letters and figures for pattern work should be cast in metal molds and vented to the outside opposite the pouring sprue. White metals containing cobalt, nickel, silver, etc., are extremely white in color, very hard, and quite expensive. Some idea as to the general composition of these metals may be obtained from the formulas in the column at right.

Fire Extinguisher Heads

Lead	27.60%
Tin	13.12%
Cobalt	7.58%
Bismuth	51.70%

Imitation Silver Fittings

Copper	57.00%
Nickel	15.00%
Cobalt	3.00%
Zinc	25.00%

Amalgams are alloys containing quicksilver (Mercury — Hg.), their hardness and melting points depending upon the per cent of mercury present. In making the amalgams the tin, zinc, etc., is first melted, allowed to cool to about 500° F. or near the "freezing point," then the mercury previously warmed to about 400° F. is added in small portions and the mixture well stirred with a pine stick.

Table of White Metal Mixtures

	Zinc	Tin	Lead	Antimony	Aluminum	Other metals
White pattern metal	50.00	50.00	....	....	....	....
Aluminum pattern metal	20.00	....	....	....	80.00	....
Zinc-aluminum	90.00	....	....	....	10.00	....
Fine pewter .....	....	86.00	....	14.00	....	....
Non-shrinkage metal .....	....	....	60.50	3.50	....	36.00 Bi.
Soft shot-metal .....	....	....	99.60	....	....	.40 As.
Hard bullet-metal .....	....	....	98.00	....	....	2.00 As.
Electrotype backing metal .....	....	4.00	91.00	5.00	....	....
Medium type metal .....	....	....	83.33	16.67	....	....
Stereotype engraving	16.00	12.00	64.00	8.00	....	....
Linotype metal .....	....	....	82.00	8.00	....	10.00 P-Sn.
Casket fittings .....	....	40.00	45.00	....	....	15.00 P-Cu.
Electric amalgam	25.00	25.00	....	....	....	50.00 Hg.

This series will be continued in an early issue.—Ed.

Zinc, Phosphorus, Nickel and Antimony in Bearing Bronze

A STUDY has been made at the Bureau of Standards, United States Department of Commerce, Washington, D. C., of copper-tin-lead bronzes, to determine the compositions best suited for bearings for various classes of service.

An early report in the monthly Technical News Bulletin of the Bureau states that tests made included wear resistance, resistance to impact (single blow), Brinell hardness, and repeated poundings. The wear resistance tests were made on an Amsler machine under conditions of rolling friction at room and elevated temperatures without the presence of lubricants. As no particular laboratory test will give all the information desired, it is necessary to study many types of tests in order to specify bearing compositions for definite conditions of service, such as in the automotive and other fields.

The effect of various additions to the copper-tin-lead alloys, namely, 4 per cent zinc, 0.05 per cent phosphorus, 2 per cent nickel, and 1 per cent antimony was determined.

Bronzes containing 5 per cent lead or over are better suited to operate without lubrication than those containing no lead. Bronzes containing lead give good bearing properties probably because lead itself acts somewhat as

a lubricant. This is not possible in a bronze containing only copper and tin.

The addition of 4 per cent zinc to copper-tin-lead alloys had no appreciable effect on wear resistance. It increased the pounding resistance at room temperature, but had no appreciable effect at temperatures of 175° C. (350° F.) and 315° C. (600° F.). The tendency was toward increased hardness and increased resistance to impact.

Phosphorus when added in amounts of 0.05 per cent also increases wear resistance and pounding resistance and has no appreciable effect on impact toughness, but slightly increased the Brinell hardness.

When 2 per cent nickel was present there was a decrease in wear resistance, but a marked increase in pounding resistance with no appreciable change in either Brinell hardness or impact toughness.

One per cent antimony was found to be undesirable from the standpoint of impact toughness and coefficient of friction, but increased the wear resistance, pounding resistance, and hardness.

This work was to have been more fully described in the August number of the Bureau of Standards Journal of Research.

The Fundamentals of Brass Foundry Practice

A Description of the Basic Laws Which Control the Melting and Casting of Metals and Their Application to Practical Foundry Work—Part 25*

By R. R. CLARKE
Foundry Superintendent

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

Figuring Metal Mixtures

IN formulating alloys to approximate distinct service requirements it must be clear now that in the great majority of cases the metals combining cannot be taken rationally, and that their effects on each other must be reckoned with just as they are known to be rather than from what might be expected of them. Almost every alloy is therefore a law unto itself.

The metal copper, already discussed, forms the base of a great variety of alloys widely diversified in their properties. These alloys are known to the trade under a number of names as brass, bronze, red brass, yellow brass, nickel silver, phosphor bronze, manganese bronze, gun metal, steam metal, plastic bronze, Muntz metal, aluminum bronze, Tobin bronze, Government bronze, etc. In every copper-base alloy the objective is to modify the properties of copper to the service requirements. Now copper possesses a number of favorable properties, among them being strength, stability, toughness, corrosion resistance, etc. It has also a variety of unfavorable properties such as frictional and hard to machine, having a high heating tendency, difficult casting, having inferior rigidity, etc. For each of these undesirable properties, some alloying metal or metals may, by combining with copper exert a modifying or nullifying influence. Of these metals, more commonly occurring in copper alloys, tin, lead, zinc, manganese, nickel, phosphorus and aluminum are most prevalent. The nature of these metals and their modifying influences on the copper properties will be considered in order.

Tin and Copper

Tin is a soft, ductile, malleable, crystalline white metal of unusual luster and high resistance to corrosion. It can be cut, hammered, rolled, bent and stretched. In the bending, it offers considerable stiffness and resistance and yields with a peculiar creaking sound, known as the "cry" of tin. Its specific gravity is about 7, its melting point about 450° F. and its boiling temperature about 2,800° F. It is the highest priced of all the metals forming the common copper alloys and for this reason is held to the minimum quantity needed.

The primary effect of tin on copper is to harden, to reduce malleability, toughness and ductility and to tend toward brittleness with its advancing ratios. At 50 copper, 50 tin, the alloy is extremely hard and brittle and will snap like glass. The original Liberty Bell is said to have contained probably 30 per cent tin and was so hard and brittle that it broke early in its history.

Three copper-tin alloys are common to practice; copper 90, tin 10; copper 84, tin 16, and copper 80, tin 20. The first is known as Gun metal of the original composition. Later practice has displaced from 2 to 4 per cent of the

copper with zinc and the formula now reads, copper 88, tin 10-8, zinc 2-4. This later alloy differs slightly from the original in properties, being less hard, more tough and less "snappy." The primary object of the zinc inclusion is to degasify and deoxidize the alloy, but when avoiding the ravages of volatilization and remaining at or near 2 per cent in the casting metal, its effect is appreciable on the properties also.

The 84-16 and the 80-20 copper tin alloys constitute the average bell metals and are hard, rigid and tending toward the fragile. Variations from these parent alloys by juggling the tin proportions to high and lower percentages are much in evidence. Thus 87 copper, tin 8, zinc 5; 82 copper, 12 tin, 2 lead and 4 zinc represent only two of the many variations observed in daily practice.

Copper-tin was originally known as bronze and is undoubtedly one of the most ancient of alloys. It is used where strength, stability and abrasion resistance are required as in valve seats, valve stems, nuts, arms, levers, bolts, etc. It was for a long time used as a bearing metal but has been largely displaced in this respect by the better alloy of copper, tin and lead. In cases where great strength and resistance are required, it still holds a bearing metal prestige as in copper 84, tin 12, lead 1, zinc 3. In the lower ratios of tin the copper-tin alloys cast best at high pouring temperatures. Thus in 88-10-2 the physical properties such as tensile, elongation, etc., show up vastly better at the higher than the lower temperatures. In the bell metals, however, more lower temperatures of pouring give cleaner and more solid castings.

Copper-tin is distinctly given to high shrinkage and in casting often gives trouble in this respect. Against this shrinkage the author has employed three weapons, chiefly, hot pouring, copious feeding and a well balanced ratio of new to recast metal in the charge. All virgin metal on the first melt shrinks disastrously. It should either be cast on the second melting or worked in with at least 50 per cent of remelted metal such as gates, scrap, etc.

Zinc and Copper

Zinc is a bluish-white, crystalline metal. Its specific gravity is about 7. It melts at about 790° F. and boils at about 1,685° F. Its chemical symbol is Zn. The copper-zinc alloy is called brass, distinguishing it from the copper-tin known as bronze. Of the straight copper-zinc alloy, two are chiefly in use, namely, copper 66⅔, zinc 33⅓, known as yellow brass, and copper 80-86, zinc 20-14. The latter combination is generally known as brazing metal and is largely used in making steam connecting flanges, etc.

The effect of zinc on copper is to toughen and cheapen it. In the straight copper-zinc this toughness almost prohibits machining and for that reason small percentages of tin and lead are alloyed with it as in copper 66, zinc 33, tin ½, lead ½. Zinc possesses the further power of deoxidizing and degasifying alloys and is included in a great many alloys of copper, tin and lead, as in 88-10-2.

* All rights reserved. This series will be collected and published in book form. Parts 1 to 24, inclusive, were published in our issues of July, August, September, October and November, 1926; January, February, March, April, May, August, September, November and December, 1927; March, May, August, September and December, 1928; March, April and October, 1929; May and August, 1930.

Higher percentages of zinc up to copper 60, zinc 40, are extensively used as in rolling mill work. In this class of work, the zinc and copper are alloyed from the highest grade virgin metals, cast into billets and rolled cold into the different commercial forms as rod, sheet, etc.

Zinc enters as the chief subordinate metal in many alloys such as manganese bronze, Muntz metal, Tobin bronze, etc., where small percentages of other ingredients are added. These will be considered later.

The zinc coloring effect on copper is to "yellow" it and results in the extensive application of copper-zinc alloys to ornamental purposes. Any high zinc alloy has an extremely high shrinkage which must be given serious consideration in casting. The author's practice is to feed rather than chill wherever the section is high, variable or heavy, much the same as in copper. Pouring temperature seems to have no great effect on the shrinking tendency. High zinc castings often run dirty and scummy due to the zinc oxide generating in the form of a bluish-white flaky substance which forms constantly, riding the metal surface and appearing on the casting surface as wrinkles. A small percentage of aluminum will relieve this tendency but the use of aluminum is not always advisable. A handful of salt thrown over the metal surface will help. At cold pouring temperature, the scum shows up worse on the casting. Copper zinc alloys are frequently required to run thin casting sections and sometimes fail. Small percentages of aluminum are often added to overcome this fault. The practice is not favorable to the quality of the metal and is never resorted to by the author except in cases of extreme necessity.

Lead

Lead is a dull, grayish, slate colored metal, soft, tough, ductile, malleable and dense. Its specific gravity is 11.3. It melts at about 620°F. and boils at about 2780°F.

The effect of lead on copper is to soften it and reduce the toughness. It renders the mixture anti-frictional. Its field is primarily in the bearing metals, the pressure metals and in small percentages to better the machinability of other alloys.

Lead has little or no affinity for copper and the straight copper-lead mixtures are comparatively rare. Along with tin and zinc, it occurs commonly in copper alloys, in varying ratios. Among these alloys are the acid resisting metals such as copper 78, lead 16, tin 4, zinc 2 and the bearing metals such as copper 80, tin 10, lead 10, or copper 78, tin 7, lead 15. It occurs further in practically all pres-

sure metals and in the red alloys it generally finds a place more or less prominent, as in copper 85, tin 5, lead 5, zinc 5, or copper 83, tin 8, lead 4, zinc 5. It is a rather weakening factor and for this reason is held to very low ratios in parts requiring strength and stability. In 88-10-2 for instance, it is prohibited. It is likewise ruled out of the high tensile alloys, such as manganese bronze, Tobin bronze, Muntz metal, aluminum bronze, etc.

Copper-tin-lead, copper-tin-zinc, and copper-tin-lead and zinc occur in a great number of alloys generally known as the red brasses and varying in properties with the ratios of the different metals in combination. Thus in 88 Cu, 10 Sn, 2 Zn as compared with 87 Cu, 8 Sn, 5 Zn, or 85 Cu, 5 Sn, 5 Pb, 5 Zn; the strength of the first is signally above that of the second and vastly superior to that of the third. In the three- or four-fold combination, the copper remains the base. Tin is the hardening and strengthening factor; zinc the cleanser. The softening, weakening, anti-frictional lead enters the combination to improve machinability and antifrictional qualities. Copper 80, tin 10, lead 10; copper 86, tin 3½, lead 3½, zinc 7; copper 85, tin 12, zinc 3; copper 83, tin 12, lead 2, zinc 3; copper 85, tin 5, lead 5, zinc 5, are a few of the many combinations of these four metals occurring commonly in foundry manipulation to-day.

As previously noted, the copper-tin-lead alloys are mainly for bearing purposes, but they also have merit in different acid resisting metals. From the bearing metals, zinc has always been excluded in quantity, though in small percentages, 1 to 2 per cent, its beneficial effect as a cleanser is an established fact. Copper-tin-zinc is the metal of strength and stability while copper-tin-lead-zinc covers the average need of a medium quality red brass.

These alloys are on the whole not difficult to manipulate. The shrinkage is normal and the gating and feeding will safely measure up to conservative estimates, except in the higher tin alloys containing zinc but no lead. Poured on the warm, rather than the cold side, they give better and cleaner castings. In the copper-tin-zinc such as 88-10-2, the pouring temperature should be well advanced on the average. Some of the most satisfactory metal the author ever made, as regarding cleanliness, tensile strength, solidity, etc., came from high temperature metal—a result which constantly failed to materialize from low temperatures. From the same pot of metal, test bars poured hot gave high physical properties, while those poured low fell below requirements.

This series will be continued in an early issue.—Ed.

Alloying Metals

Q.—WE need instructions for using 15% phosphor copper, 10% silicon copper, 30% manganese copper, and phosphorous in miscellaneous alloys. We believe you have data on this work and would appreciate your advice.

A.—Silicon copper is used as a deoxidizer. Foundries experience difficulty in obtaining perfect, sound castings free from blow holes. The molten metal dissolves gases, but upon cooling and solidifying the oxygen is again set free and the natural consequence is that the gas remains in small bubbles throughout the solid metal, each bubble being a small blow hole or flaw. Silicon, added in the form of silicon-copper, combines with the oxygen in the oxidized gas and prevents blow holes. Only a very small amount of silicon-copper is required.

Silicon-copper is also added to copper for manufacturing telephone cable. It increases the breaking strain without impairing the conductivity. It is also used in 30% zinc alloy. It reduces oxides. Silicon-copper is best

added a few minutes before drawing the metal from the furnace; it should be stirred well and skimmed before pouring. Three to six ounces in 100 pounds has been found sufficient to deoxidize copper or gun metal.

Manganese is also a deoxidizer and is used in small proportions as such. In bronze the tensile strength is increased by its use.

Fifteen per cent phosphor copper: principal use is as a deoxidizer and flux. It frees metal from oxygen, makes it run more freely, and helps the metals to thoroughly alloy. It also increases the hardness and the elongation. It is used in small amounts. It is easier to handle in the form of 15% phosphor copper than as stick phosphorus.

All deoxidizers are "medicine" and are used as such. An overdose of medicine is detrimental to the patient and the same thing holds true with metal. So phosphor and phosphor-copper, silicon-copper and 30% manganese copper are deoxidizers and are helpful in the foundry.

WILLIAM J. REARDON.

British Institute of Metals Meeting

Synopses of Papers Presented at the Annual Autumn Meeting Held in Southampton, England, September 9-12, 1930.

NINTH AUTUMN LECTURE, ON THE USE OF NON-FERROUS METALS IN THE AERONAUTICAL INDUSTRY, by D. HANSON.

WHILE it is perhaps true that the first airships and aeroplanes owed little to the use of non-ferrous metals, the present state of aerial transport is in large measure due to the development of suitable alloys and their use in aircraft construction in large quantities. Metals first entered into aircraft in appreciable quantities in the construction of the engines, and the modern high powered units of low weight owe much to the extensive employment of non-ferrous alloys. More recently, improvements both in design and in materials have made possible the development of strong reliable all-metal structures, suitable both for aeroplanes and airships. The alloys used must be strong for their weight; this requirement is fulfilled by some of the alloy steels, and by the high grade aluminium and magnesium alloys, but the steels are at some disadvantage owing to their greater density, which prevents their use in many directions owing to the thin sections that would be required to take advantage of their greater strength. The non-ferrous alloys also possess the advantages that they can readily be used as die-castings, forgings, stampings, and so on, and lend themselves more readily to the methods of standardized production that are already being adopted, and will become essential as popular flying extends.

Perhaps the most notable feature in regard to aluminium alloys is the extent to which heat-treatment is employed in developing their useful properties. All the important wrought alloys are used in a heat-treated condition, and there is a growing tendency to use castings similarly manufactured, and important developments have recently been made in both types of alloy.

The use of magnesium alloys is of more recent origin, but is rapidly extending. Improvements in melting and casting methods, as well as the discovery of new alloys, have contributed to this extension and there are already indications that the application of the processes of heat-treatment in suitable instances, as is done for aluminium alloys, will lead to further improvements. There is every indication that magnesium alloys will enter largely into aircraft construction in the future.

The development of rustless iron and nickel alloys will also be watched with interest, as they may well find application on account of their resistance to corrosion, although there are many directions in which the alloys of low density are not likely to be displaced.

ROLLED GOLD: ITS ORIGIN AND DEVELOPMENT, by ERNEST A. SMITH.

The paper deals briefly with the history of the rolled gold industry from its beginning in Birmingham, in 1817, until the present time. Development has been gradual, but today the industry forms an important branch of the imitation jewellery trade of which Birmingham is one of the most important centers. Since 1841 rolled gold has had to compete with electro-gilded articles of jewellery. A short account is given of the methods in use for distinguishing between rolled gold and gilded materials.

The modern methods of manufacture are briefly de-

scribed. In the final section is given the legal definition of rolled gold and its allied materials.

GAS REMOVAL AND GRAIN REFINEMENT OF ALUMINIUM ALLOYS, by W. ROSENHAIN, J. D. GROGAN and T. H. SCHOFIELD.

A number of selected volatile chlorides have been passed into molten aluminium and certain alloys. All were found to be efficacious in removing dissolved gas from the metal. Some, particularly titanium tetrachloride, also produce a marked reduction in grain-size. The reduction of grain-size occurs also when titanium is added to aluminium in the form of titanium-aluminium alloy produced by the "Thermit" process.

PRESSURE DIE-CAST ALUMINIUM ALLOY TEST-PIECES, by J. D. GROGAN.

This paper reports an investigation of the mechanical strength of certain aluminium alloys when pressure cast in the form of small tensile test-pieces. The behavior of selected alloys when subjected to the attack of molten aluminium alloy and the method of entry of metal under pressure into a simple cylindrical mould are described. Results of tests of pressure die-cast tensile test-pieces indicate that, if certain serious technical difficulties can be overcome, the pressure casting process will yield products of excellent mechanical properties.

THE DIFFUSION OF ALUMINIUM INTO IRON, by N. W. AGEW and OLGA I. VHER.

The action of aluminium on iron has been investigated. The process takes place in two stages: (1) Solution of iron in liquid aluminium; (2) diffusion of the alloy formed into solid iron. The structure of the region where the action occurs has been studied, at different temperatures, both for the first and the second stages. Weiss' Law of Diffusion has been verified for the binary system iron-aluminium, and the variations of the rate of diffusion with temperature and time demonstrated. The data of other investigators of the system iron-aluminium have been critically examined, and a diagram, which is considered to be most nearly correct, has been constructed after a series of check experiments.

THE ARTIFICIAL AGEING OF DURALUMIN AND SUPER-DURALUMIN, by K. L. MEISSNER.

The effect of artificial ageing from 50° to 200°C. upon two commercial Duralumin alloys, 681B and 681B1/3, and upon super-Duralumin (Duralumin with addition of silicon) has been investigated. The periods of tempering were generally 20 and 40 hrs. The artificial ageing was applied in the first series after ageing at room temperature; in the second series immediately after quenching from high temperatures (about 500°C.). No substantial difference was observed between the two series.

In a third series, test-pieces were artificially aged after having been age-hardened at room temperature and cold-rolled. In this series, an interesting phenomenon could be observed at about 100° to 125° C. in that material was produced having high tensile strength and elongation,

combined with a yield-point which was about 33 to 53 per cent higher than obtained in the two other series investigated.

The effect of artificial ageing upon Duralumin consists, after an initial softening at lower temperatures, mainly in raising the yield-point, whilst the tensile strength is influenced only slightly. At the same time, the elongation, flexibility, and other cold-working properties are decreased very markedly, and as shown in previous work the resistance against corrosion is also decreased.

In contrast to Duralumin, the tensile strength of super-Duralumin is markedly raised by artificial ageing, but the rise keeps behind that of the yield-point, relatively. The other properties are, in general, substantially the same as those for Duralumin.

LATTICE DISTORTION AS A FACTOR IN THE HARDENING OF METALS, by WM. L. FINK and KENT R. VAN HORN.

Rockwell hardness measurements and diffraction patterns showed that lattice distortion can be accompanied by appreciable softening in an externally stressed aluminium alloy ("17S") or α brass. The curve representing stress versus hardness relations in the elastic range is given.

It was found in certain "17S" alloy specimens that lattice distortion resulting from quenching stresses approximating the elastic limit did not alter the hardness.

References are cited to show that maximum lattice distortion and maximum hardness are not necessarily coincident in age-hardened alloys.

Results indicate that considerable caution should be exercised in attributing the hardening of metals to lattice distortion.

A STUDY OF THE RELATION BETWEEN MACRO- AND MICROSTRUCTURE IN SOME NON-FERROUS ALLOYS, by MARIE L. V. GAYLER.

The results of a previous investigation are confirmed—i.e., the higher the temperature from which an alloy is cast the coarser becomes the macrostructure, and at the same time the microstructure becomes finer, but in a less marked degree.

Variation in the ratio of the cross-section of the mould to that of the casting affects both macro- and microstructure, but provided this ratio remains constant and the casting temperature is not much above the liquidus, there is little difference in either the macro- or microstructure of alloys whether cast into steel or graphite moulds. If, however, the casting temperature is raised the macrostructure of the alloy cast into a steel mould is slightly different from that cast into a graphite mould, but the microstructures are almost identical.

The macro- and microstructure of an alloy does not seem to be affected by various gases, **provided the casting temperature is kept low**. If, however, the casting temperature is raised, the atmosphere to which the molten metal is exposed has a very marked effect on the macrostructure, together with a small effect on the microstructure. Hydrogen, under the conditions mentioned, causes the formation of a fine macrostructure in contrast to that obtained on casting under normal conditions.

It has been shown that a copper-aluminium alloy which has been previously freed from gas by the nitrogen process and then melted *in vacuo* still shows inverse segregation; also the effect on segregation in an alloy which has been exposed to nitrogen or hydrogen has been noted.

It appears that the presence of furnace gases has little effect on the "modification" of aluminium-silicon alloys.

"Modification" of a silicon-aluminium alloy cannot be obtained by casting into a heavy, water-cooled copper mould.

THE EFFECTS OF TWO YEARS' ATMOSPHERIC EXPOSURE ON THE BREAKING LOAD OF HARD-DRAWN NON-FERROUS WIRES, by J. C. HUDSON.

Details are given of tests on a number of hard-drawn non-ferrous wires, in which determinations of the breaking load were made before and after exposure to the South Kensington atmosphere for two years. Owing to the fact that appreciable changes took place in the strength of the unexposed wires, it is not possible to arrange the materials in a definite order of merit as regards resistance to atmospheric corrosion. The losses in strength after two years' exposure were, however, very small, and the observations confirm the results of earlier work in showing that under straightforward conditions the majority of non-ferrous materials are very resistant to atmospheric corrosion. Brass is an exception to this statement, as its strength is adversely affected by the copper redeposition that accompanies atmospheric corrosion. A few remarks are made on the atmospheric corrosion of copper-nickel alloys.

THE OPEN-AIR CORROSION OF COPPER. PART II.—THE MINERALOGICAL RELATIONSHIPS OF CORROSION PRODUCTS, by W. H. J. VERNON, and L. WHITBY.

The composition of patina from copper structure of various ages in representative localities has been critically examined with the view to ascertaining whether definite formulae could be ascribed to the principal constituents. Complete agreement with the formula of the corresponding mineral has been realized in products after 70 years' exposure and upwards. Basic copper sulphate (under most conditions the major constituent) then coincides in composition with brochantite, $\text{CuSO}_4 \cdot 3\text{Cu}(\text{OH})_2$; basic copper chloride (in products near the sea-board) with atacamite, $\text{CuCl}_2 \cdot 3\text{Cu}(\text{OH})_2$; basic copper carbonate (usually present but in minor proportion) with malachite, $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$. After shorter periods of exposure the basicity of the product is lower than that of the corresponding mineral.

SILICON-COPPER ALLOYS AND SILICON-MANGANESE-COPPER ALLOYS, by E. VOCE.

The paper records a survey of silicon-copper and of silicon-manganese-copper alloys, studying their mechanical and physical properties in the cast, drawn, and rolled conditions, with a view to developing and extending their uses. Their resistance to corrosion has received attention especially in the light of the development in America of alloys of copper with silicon and manganese in connection with chemical plant.

The paper has been divided into the following sections:

- I. INTRODUCTION.
- II. CONSTRUCTION OF THE SILICON-COPPER ALLOYS.
- III. SILICON-COPPER ALLOYS:
 1. The Properties of Cast-Silicon-Copper Alloys.
 2. The Mechanical and Electrical Properties of Silicon-Copper Wire containing up to 1 per cent of Silicon.
 3. The Production and Properties of Silicon-Copper Sheet.

IV. SILICON-MANGANESE-COPPER ALLOYS:

1. Introductory Remarks.
2. The Preparation of a Series of Alloys for Examination.
3. Microscopic Examination.
4. The Mechanical Properties of Cast-Silicon-Manganese-Copper Alloys in the Cast Condition.
5. The Production and Properties of Silicon-Manganese-Copper Sheet.

V. CORROSION TESTS.

VI. OXIDATION OF SILICON-COPPER AND SILICON-MANGANESE-COPPER ALLOYS AT HIGH TEMPERATURES.

VII. SUMMARY AND CONCLUSIONS.

APPENDIX: THE MATERIALS USED.

ACKNOWLEDGMENTS.

A NEW SILICON-ZINC-COPPER ALLOY, by DR. E. VADERS.

The range of the α -solid solution phase at the copper end of the diagram has been determined and it is shown that the 90% copper alloy can take up 4.5% silicon into solid solution. Earlier investigators considered 2% silicon to be the maximum solid solubility in this alloy and regarded all alloys with more silicon than this as brittle and therefore useless. The present work shows, however, that alloys with 2-5% silicon and 70-90% copper have valuable properties. The best alloys within this range are those with 80-82% of copper; these can be forged hot, rolled and extruded and give good castings in chill sand or pressure moulds. The cast alloys have a dense uniform structure free from shrinkage cavities even in the thickest parts. In the cast state the tensile strength exceeds 50 kg./mm.² with an elongation of 10-15%; after forging or drawing these figures rise to 65-85 kg./mm.² and 30-10% respectively. According to the state of the alloy, whether cast, pressed or drawn, the hardness varies from 120 to 170. The alloys are suitable for the manufacture of bearings and bells. For the latter purpose they give results equal in every way to those obtained with a good tin-bronze.

THE EFFECT OF PHOSPHORUS ON THE STRENGTH OF ADMIRALTY GUN-METAL, by H. C. DEWS.

The effect of phosphorus up to 0.131 per cent on the tensile strength, elongation, Brinell hardness, density, and

microstructure of sand-cast Admiralty gun-metal has been investigated. Particular attention has been paid to the effect of casting temperature on the alloys. It is shown in the paper that phosphorus up to approximately 0.05 per cent has little effect on the mechanical properties or structure of Admiralty gun-metal. Above 0.05 per cent phosphorus causes the appearance of free Cu_3P and at the same time a reduction in the mechanical properties.

A NOTE ON THE CONSTITUTION OF THE CADMIUM-ZINC ALLOYS, by D. STOCKDALE.

Recent work on the constitution of these alloys has indicated that Jenkins has underestimated the mutual solubilities of the two metals. The author finds that zinc is somewhat more soluble in cadmium than Jenkins has shown, but there is exact agreement about the constitution of the zinc-rich alloys. The discovery that certain of the alloys partially liquefy on a falling temperature has been confirmed.

"PENDULUM" HARDNESS TESTS OF COMMERCIALLY PURE METALS, by D. A. N. SANDIFER.

Investigation limited to metallic elements. Description of 24 metals tested. Description of the hardness tester. Conversion to Brinell hardness numbers. Methods of preparation and testing. Definition of time work-hardening capacity. Relation between time hardnesses for different pendulum lengths. Relation between scale hardness and scale work-hardening capacity. Relations between time hardness, Young's modulus, and relative atomic volume. Effects of rolling. Effects of impurities.

HEAT-TREATMENT, BALL-HARDNESS, AND ALLOTROPY OF LEAD, by F. HARGREAVES.

From quenching and ball-hardness tests on lead of high purity, it is suggested that lead is allotropic, the suggested critical points being 187°C. and 228°C., approximately. The hardness varies greatly with the heat-treatment.

Very marked changes take place in the hardness immediately after quenching.

The presence of 0.005 per cent tin inhibits these marked changes and they do not take place in commercially pure lead.

Each sample tested shows increased hardness resulting from quenching.

The Electric Arc Welding of Aluminum

By W. M. DUNLAP*

During the past few months rather extensive investigations of the application of the arc welding process to aluminum and its alloys have been conducted in the Aluminum Research Laboratories of the Aluminum Company of America, under the supervision of the author. As a result of this work the process has been developed to the point where within certain limits it may be considered practical as a production method. At the present time the successful commercial arc welding of aluminum and its alloys is being done by several metal fabricating plants.

The equipment required for arc welding aluminum is

practically the same as that used for similar work on other metals.

The electrodes are of the flux coated type. The whole secret of successfully arc welding aluminum and its alloys depends upon the use of a proper flux. Reversed polarity, a very short arc, and comparatively low amperages are used. The exceptionally high temperature of the arc, together with the short flame, is an important factor in developing improved physical properties of arc welds in aluminum as compared with torch welds. The high temperature produces rapid fusion in the work and the electrode while the short arc localizes the heat. These properties greatly reduce the width of the heat affected area in the sheet, with a corresponding increase in weld efficiency.

The paper also discusses the welding technique and special applications of the process.

* Abstract of a paper read at the Fall Meeting of the American Welding Society, September 22-26, 1930, in Chicago, Ill.

American Electrochemical Society Meeting

Abstracts of Papers Presented at the
Fifty-Eighth General Meeting Held at
Detroit, Mich., September 25-27, 1930

THE ELECTRODEPOSITION OF LEAD-THALLIUM ALLOYS

By COLIN G. FINK and CLARENCE K. CONARD JR.

Alloys of lead-thallium containing from 20 to 65 per cent Tl are among the most insoluble alloys known. The co-deposition of the two metals was investigated, and it was found that good, smooth, adherent deposits of an alloy containing approximately 70 per cent lead were obtained from a perchlorate bath of the two metals (30 g./L. Tl; 5 g./L. Pb) at a current density of about 5 amp./sq. ft. (0.54 amp./sq. dm.) and 25° C.

CALCIUM CHLORIDE TESTING OF ELECTROPLATED DEPOSITS

By H. C. MOUGEY

Calcium chloride has become a common dust and puddle constituent on many of the automobile highways. It is much more corrosive to plated parts than sodium chloride. However, no quantitative relation between the salt spray test and the calcium chloride spray test could be established. Calcium chloride will attack chrome-plate more easily than sodium chloride, due possibly to the interaction of the carbonic acid of the air with the calcium chloride, forming free hydrochloric acid. The calcium chloride spray test is recommended to the chromium plating industry, as an aid in developing a more resistant chrome plate.

THE COMPUTATION OF THROWING EFFICIENCY

By L. C. PAN

Haring and Blum's definition of throwing power and Heatley's modification of same were reviewed. "Throwing efficiency" was proposed to designate Heatley's definition. Throwing efficiency is a value which indicates how nearly the throwing power is approaching perfection. Cadmium, nickel and acid zinc baths were used in an experimental study of both the throwing power and throwing efficiency with different primary current distribution ratios. Throwing efficiency gives a more uniform value with change of the primary ratio, but it still varies with the primary ratio. A simpler and more practical method of determining throwing power of electroplating baths is needed.

HEAT TREATMENT OF CHROMIUM DEPOSITS TO INCREASE THEIR RESISTANCE TO CORROSION

By R. J. WIRSHING

Copper panels chromium plated at low current densities and high bath temperatures were more resistant to calcium chloride corrosion than panels plated at higher current densities and/or lower temperatures. Greater corrosion resistance is attributed to lower hydrogen content of the plate. Upon removing most of the hydrogen through heat, a seven-fold improvement in corrosion resistance was noted.

THE DEPOSITION OF NICKEL-COBALT ALLOYS

By COLIN G. FINK and KIHUGH H. LAH

The co-deposition of cobalt and nickel from the sulfate-chloride bath was investigated. A *silver-white* deposit can be obtained within the wide range of 55 to 75 per cent Ni and 45 to 25 per cent Co. Cobalt dissolves anodically more readily than nickel in the sulfate-chloride bath, and also deposits cathodically more readily than nickel. Increasing the total metal concentration of the bath increases the cobalt content of the plate. Increasing the temperature of the bath, decreasing the acidity, or increasing the cathode current density likewise increases the cobalt content of the plate. The white alloy plate is more than three times as hard as nickel, and decidedly more resistant to corrosion than nickel.

THE DEPOSITION OF NICKEL AT A LOW pH

By W. M. PHILLIPS

The advent of highly corrosion-resistant nickel-chromium steels in thin sheet form has spurred the plating industry on to improve the quality of its work. Deposits of nickel thicker than the usual 0.0002-inch (0.8 micron) are costly when using the standard pH of 5.3 and above. However, with pH below 3.0 much higher current densities are possible and good, heavy deposits obtained. In the low pH bath the nickel content is kept constant by a fairly uniform anode dissolution. No peeling or cracking at the edges is apparent. The bath remains clear. However, with the low pH bath, there is a greater initial tendency towards pitting. Cathode efficiencies are about 75 per cent, as compared with 95 per cent with the standard pH. Lower bath temperatures are recommended for the low pH bath. Zinc base die castings are more difficult to plate with the low pH bath.

ELECTRODEPOSITION OF IRON-NICKEL ALLOYS FROM CYANIDE SOLUTIONS

By LAWRENCE E. STOUT and JONAS CAROL

It is shown that an alloy containing nickel and iron may be deposited from solutions containing potassium nickel cyanide, potassium ferrocyanide, and potassium tartrate. Plates are deposited over wide ranges of temperature and current density. The compositions of the plates are tabulated and plotted in curves to show the variation in composition of deposit with variations in composition of solution, current density and temperature.

THE PLATING ON RADIATOR SHELLS

By OLIVER P. WATTS

Photographs of the plating on radiator shells are shown, accompanied by a description of the preparation of the steel and the details of plating. Heavy electrodeposits on steel are prescribed, to insure lasting protection against corrosion. The proper preparation of the steel surface preliminary to plating is an important factor. The actual thickness of various copper, nickel and

chromium deposits was determined microscopically. Tests were made for pin holes and cracks in the plates. Finally samples were immersed in a 35 g./L. NaCl solution. Many specimens were in good condition after 23 days' immersion.

THE PREPARATION OF PURE ELECTROLYTIC NICKEL Part Two. The Final Elimination of Copper and the Removal of Cobalt and Iron

By COLIN G. FINK and F. A. ROHRMAN

The electrochemical methods for removing traces of copper and cobalt from nickel sulfate solutions were further investigated. When two or more metals are present in solution, it is difficult to predict which one will preferably deposit on the cathode, owing to many conflicting factors. By carefully selecting and controlling such factors as temperature, current density, hydrogen ion concentration, and cathode polarization film thickness, one metal may be deposited in preference to others even when such metal is present in solution in relatively small concentrations. The cathode polarization film thickness can easily be varied by employing a rotating cathode, operated at speeds of from 1,000 to 6,000 r.p.m. or a rapidly circulated catholyte. The concentration polarization effect at the cathode can be almost entirely eliminated by means of the high speed rotating cathode or by a rapidly circulated catholyte. Copper was removed almost quantitatively from solutions containing as little as 0.001 per cent copper. Copper was readily recovered from tails waters containing 0.01 per cent copper and 0.02 per cent iron, which latter, under ordinary conditions, prevents deposition of copper. From a solution containing both nickel and cobalt, in the ratio 100:1, a nickel-cobalt alloy deposit was obtained, containing over 40 per cent cobalt. The commercial possibilities of a high-speed rotating cathode or of a vigorously circulated catholyte are discussed, and commercial adoption of the method briefly outlined. The nickel metal obtained is free from cobalt and iron, and contains only a trace of copper, less than can be determined chemically.

ELECTROLYTIC RECOVERY OF LEAD FROM LEAD SULFATE WASTE

By COLIN G. FINK and LAWRENCE GREENSPAN

An economical method of recovering lead from lead sulfate, which occurs as a by-product in a number of industries, constitutes a problem which has not as yet been satisfactorily solved. The present investigation was therefore undertaken to discover a practicable method for utilizing this waste material. Pyrometallurgical and chemical methods suggested in the past are briefly reviewed, and found to be impracticable. A new electrochemical method is proposed and developed. The electrolyte contains from 50 to 55 g./L. PbSO_4 and 200 to 240 g./L. NaOH; current density 1.6 amp./sq. dm.; temperature of electrolyte 65 to 70° C.; lead-silver anodes; current efficiency 95-98 per cent. The cell is divided into two compartments by an alundum diaphragm. Two valuable by-products are obtained, red lead and glauber salt. The cathode deposit of metallic lead produced in the presence of glue as an addition agent is crystalline and well adherent.

THE TITRATION OF POTASSIUM CYANIDE, AND OF FREE CYANIDE IN SILVER-PLATING SOLUTIONS, BY MEANS OF SILVER NITRATE

By EDWARD B. SANIGAR

The effect of the presence of carbonate on the titration, by silver nitrate, of potassium cyanide solutions, and of the free cyanide present in silver-plating solutions,

has been studied. The presence of carbonate has been shown to give rise to persistent precipitates during titration of the cyanide. The formation of these precipitates has been shown to be avoidable by the use of dilute solutions. Apart from these precipitates, carbonates were found not to interfere with these titrations. The removal of the carbonate by barium nitrate, barium chloride, calcium chloride or strontium nitrate was found to produce erroneous results, and to complicate the titrations by promoting precipitate formation. Additions of small amounts of $N/10$ sodium hydroxide were found to be without effect on the titration result, or on the formation of precipitates. Titration of the cyanide without using potassium iodide as indicator was found to yield slightly high results. It was found that additions of ammonium hydroxide obviated precipitate formation, but that the concentration of ammonia had to be correlated carefully to the amount of potassium iodide used as indicator, if accurate results were to be obtained.

UNUSUAL CORROSION OF ALUMINUM BY ALKALI

By OLIVER W. STOREY

A peculiar case of pitting of aluminum electric oven walls was investigated. The corrosion of the aluminum was found to be caused by the caustic soda of the sodium silicate adhesive used for the built-up asbestos insulation, in the presence of excessive moisture. The sheet asbestos acts as a dialyzing membrane for the sodium silicate and allows silicate-free caustic soda to reach the aluminum sheet.

THE THEORY OF ELECTRODES

By E. NEWBERY

The whole theory of electrode behavior has been reviewed, including single potential determinations, overvoltage, transfer resistance, valve action, and passivity.

Normal electrode potentials are periodic functions of the atomic numbers of the elements, and those of the inert gases are probably zero.

When a gas is liberated at an electrode, transfer resistance always appears, and is due to the purely ohmic resistance of a film of gas under high pressure, covering the electrode. The properties of transfer resistance are described, and an explanation given of the function of platinizing electrodes for conductivity determinations.

Under the same conditions, overvoltage usually, but not always, appears. This is due to the formation of compounds of the liberated gas with the material of the electrode, under the influence of the very high pressures present. The properties of overvoltage are briefly described.

Valve action occurs when the anodic compound is insoluble in the electrolyte and an electrical insulator, forming a covering film which is permeable to hydrogen ions but impermeable to the anions present.

Passivity occurs when the anodic compound is insoluble in the electrolyte, and is also an electrical conductor.

OUTDOOR ATMOSPHERIC CORROSION OF ZINC AND CADMIUM ELECTRODEPOSITED COATINGS ON IRON AND STEEL

By C. L. HIPPENSTEEL and C. W. BORGMANN

Experimental data are presented on the rates of corrosion of electroplated zinc, zinc alloy and cadmium protective coatings on steel in a severely industrial atmosphere, and in a similar atmosphere, but accelerated by additional rainfall simulated by a water spray. These data show that zinc and zinc alloy coatings corrode at a slower rate than cadmium coatings. However, under the accelerated exposure the difference is not so pronounced.

Plating Tank Rheostats

Some Factors Affecting the Heating and Ampere Carrying Capacity of Tank Rheostats

By M. M. ROSE

Chief Engineer, Columbia Electric Manufacturing Company, Cleveland, Ohio

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

MOST tank rheostats are designed for a 3 volt drop so that when used on a 6 volt bus circuit, with rated ampere capacity flowing through the rheostat, the voltage drop in the rheostat will be 3 volts giving 3 volts across the tank.

It is common practice, however, to operate the rheostat with voltage drops in excess and likewise lower than the rated 3 volt drop. Figure A, shows the variation in am-

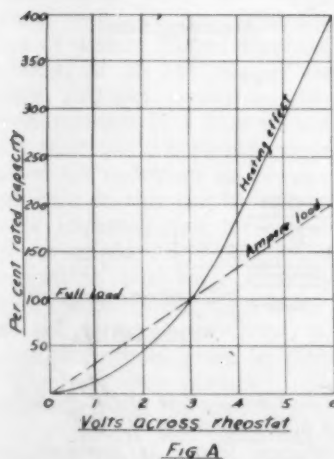


Fig. A—Variation in Ampere Load on Rheostat.

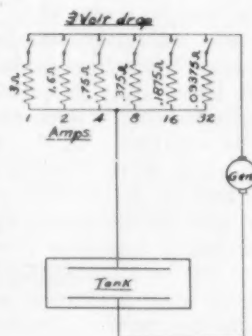


Fig. B.

Fig. B—Typical Tank Rheostat.

pere load on a rheostat according to the voltage drop across it. It will be noted that at 3 volts, the normal ampere rating and the heating effect would be 100%.

Increasing the voltage drop to 4, corresponding to 2 volts on the tank, would increase the ampere load 33% and the heating effect 78%. The extreme case would be for rheostat connected directly across the bus terminals under which condition the ampere load would be 200% and the heating effect 400% of normal.

From the foregoing it is evident that:—

1. A rheostat designed for 3 volt drop should be liberally constructed so as to withstand the maximum overload to which it may be subjected.

2. Ample current carrying capacity must be provided not only in the resistors but also in the conductors and contact surfaces.

The following mathematical proof of the factors involved are based on the formulae covering Ohms laws and the equivalent resistance of parallel and series circuits.

$$\text{Amperes} = \frac{\text{Volts}}{\text{Ohms}}$$

$$\text{Volts} = \text{Amperes} \times \text{Ohms}$$

$$\text{Ohms} = \frac{\text{Volts}}{\text{Amperes}}$$

$$\text{Equivalent Resistance for parallel circuits} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \text{etc.}}$$

$$\text{Watts} = \frac{\text{Volts} \times \text{Volts}}{\text{Ohms}}$$

$$\text{Watts} = \text{Amperes} \times \text{Amperes} \times \text{Ohms}$$

Figure B is intended to represent a typical tank rheostat having a total rated capacity of 63 amperes with all switches closed and for a condition of 3 volts drop across the rheostat. Such a condition would prevail on a 6 volt bus system with a tank requiring 3 volts to secure the proper condition of electroplating and likewise with anode and cathode surface in the tank to require a 63 ampere current.

The values of course represent conditions which will not be exactly reproduced under ordinary conditions of commercial plating, but the figures will serve to emphasize the effect on the operation of the parallel resistor type tank rheostat.

It will be noted that the nominal rating of the 6 resistor steps, namely, 1, 2, 4, 6 and 16 and 32 amperes gives a total capacity of 63 amperes with steps of 1 ampere from one to 63 amperes. In order to secure 3 volt drop, the resistance of the various steps are as indicated and are calculated from the above formula:

$$\frac{3 \text{ volts}}{1 \text{ amp.}} = 3 \text{ ohms}$$

$$\frac{3 \text{ volts}}{2 \text{ amps.}} = 1.5 \text{ ohms}$$

$$\text{the 32 ampere step has a resistance of } \frac{3 \text{ volts}}{32 \text{ amps.}} = .09375$$

ohms. In larger size rheostats, steps of 200 amperes are not uncommon so that the resistance of such a section

$$\text{would be } \frac{3 \text{ volts}}{200 \text{ amps.}} = .015 \text{ ohms. Resistance equivalent to}$$

these values can easily be encountered due to poor joints, occasioned by loose or dirty contacts.

Referring to our typical case, if we assume a load in the tank requiring 1 ampere, the equivalent tank resistance would be 3 ohms. With the first switch closed, we would have the voltage equally divided with a 3 volt drop across the rheostat and a 3 volt drop across the tank. Now let us assume that more work is added to the tank decreasing the equivalent resistance to $1\frac{1}{2}$ ohms corresponding to 2 amperes at 3 volts on the tank, but with only the first switch closed. We then have a condition of a total resistance of 3 ohms in the rheostat, plus $1\frac{1}{2}$ ohms in the tank, or a total of $4\frac{1}{2}$ ohms. The current in the circuit

will be $\frac{6 \text{ volts}}{4\frac{1}{2} \text{ ohms}} = 1.33 \text{ amperes}$. In other words, instead

of 2 amperes in the tank we get only 1.33 amperes. Furthermore, instead of 1 ampere on the resistor designed for that capacity, we have 1.33 amperes which corresponds to a 33% overload in amperes, and 78% increase in heating.

The values are not such as are ordinarily encountered in commercial work, but the percentage will be the same whether we choose a step of one ampere or 100 amperes. Condition requiring 2 volts on the work, necessitating 4 volt drop in the rheostat.

With switches 1, 2 and 3 in, namely, 1 ampere 2 amperes and 4 amperes, the equivalent resistance of this circuit would be

$$\frac{1}{\frac{1}{3} + \frac{1}{1.5} + \frac{1}{.75}} = .428 \text{ ohms}$$

Assuming 2 volts required on the work, and 4 volts drop required in the tank rheostat, the current would be

$$\frac{4 \text{ volts}}{.428 \text{ ohms}} = 9.35 \text{ amperes}$$

Inasmuch as the sections are normally designed for 1 plus 2 plus 4 amperes or a total of 7 amperes, this would correspond to an overload

$$\frac{9.35}{7} = 1.33, \text{ or a } 33\% \text{ overload in ampere capacity}$$

with equivalent overload in heating of 78%.

Condition requiring 1.5 volts on work.

Closing switches 1, 2 and 3 gives the same equivalent resistance as cited in the previous case namely, .428 ohms. With 1½ volts on work, there would be required a 4½ volt drop in the rheostat. Current flowing would be

$$\frac{4.5 \text{ volts}}{.428 \text{ ohms}} = 10.5 \text{ amperes}$$

The normal rated ampere capacity of these 3 sections would be 7 with 10½ amperes flowing corresponding to

$$\frac{10.5 \text{ amps}}{7 \text{ amps}} = 1.5 \text{ or } 50\% \text{ ampere overload capacity}$$

overload. The heating effect would be 225% or a 125% overload.

Condition requiring 4 volts on the work.

With all switches closed, we would have an equivalent resistance of .0475 ohms. 4 volts on the work would require 2 volt drop in the rheostat.

$$\frac{2 \text{ volts}}{.0475 \text{ ohms}} = 42\frac{1}{2} \text{ amperes}$$

In other words the rheostat being designed for a 3 volt drop, it will only be possible to secure 42½ amperes or

$$\frac{42\frac{1}{2} \text{ amps}}{63 \text{ amps}} = 67\frac{1}{2}\% \text{ of the normal rated capacity of the rheostat}$$

Condition requiring 3 volt drop on the tank and all switches closed with a resistance in the tank circuit due to poor contact, equivalent to .01 ohms. Under normal conditions without the external resistance inserted, and with proper anode and cathode surface in the tank, we would have 63 amperes flowing in the tank circuit. The equivalent resistance of the electroplating bath would be the same as for the tank rheostat namely, .0475 ohms. Total resistance would be 2 times .0475 or .095 ohms.

$$\frac{6 \text{ volts}}{.95 \text{ ohms}} = 63 \text{ amperes}$$

Now assume the additional resistance of .01 ohms due to poor or dirty contact. Total resistance will be .095

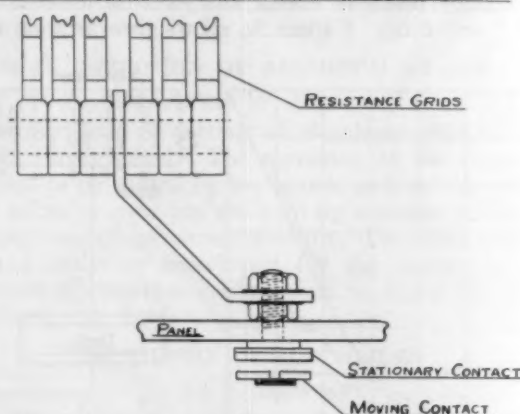
$$\frac{6 \text{ volts}}{.104 \text{ ohms}} = 57\frac{1}{2} \text{ amps}$$

A decrease of approximately 8%.

It should be noted that a resistance of .01 ohms represents only a very small value and would correspond to the resistance of approximately 28 feet of No. 5 round wire which wire would be of sufficient capacity to carry 63 amperes.

A further result of a poor contact is the excessive amount of heat at this point of contact. In the present instance, assuming a resistance of .01 ohms with 63 am-

IDEAL TANK RHEOSTAT ARRANGEMENT SHOWING METHOD OF MAKING CONTACT BETWEEN GRIDS AND TOGGLE SWITCH



peres flowing, the watts heat loss at this point will be 63 amperes times .01 equals approximately 40 watts.

The effect of these resistance joints is particularly noticeable with high currents and if we assume for example a current of 1,000 amperes flowing across a resistance joint of .01 ohms, we have a heat loss of 1,000 squared times .001 equals 1,000 watts. The result of such poor joints causes expansion as the current increases and contraction when the current decreases with the result of loosening at these points and gradual deterioration due to heating and corrosion and likewise as this condition becomes progressively worse, it eventually results in a burn-out at this point.

In the instance cited above, the current of 1,000 amperes flowing through a resistance of .001 ohms would occasion a 1 volt drop at this point.

Even should the resistance be decreased to .001 ohms, the voltage drop would be 1/10 of a volt and the heating 100 watts.

Note that an unnecessarily high bus voltage requires a greater voltage drop across the tank rheostat. This condition however seldom occurs.

From the foregoing it is evident that:

1. Even though a resistor may be designed for a normal voltage drop of 3 volts, there are many cases where due to the different class of work which must be done in the same tank and with the same rheostat, it becomes necessary to use the same rheostat for voltage drop of 4 or 4½ volts. Under these conditions, the rheostat will become overloaded.

Therefore a rheostat should be chosen having a liberal ampere overload capacity.

2. Resistance joints create a considerable voltage drop and an excessive amount of heating at the point of contact. For this reason solid contacts secured between clean flat surfaces are necessary and these contacts must be securely held together.

The Coloring of Cadmium

A Survey of Possible Reagents and a Report of Experimental Work—Part 2, Conclusion*

By ING. CHEM. HUGO KRAUSE

TRANSLATION OF AN ARTICLE ENTITLED "METALLFÄRBUNG DES KADMIUM," APPEARING IN MITTEILUNGEN DES FORSCHUNGSINSTITUTS UND PROBIERAMTS FÜR EDELMETALLE, 3, 45, 56, 72 (1920) and 4, 16 (1930).

Recipes for Permanganate Solutions

THE permanganate bath is used in very many varied compositions. Buchner recommends for example 20 gm. copper sulphate and 5 gm. potassium permanganate in 1 litre of water; Groschuff, who tested the bath in the Physikalisch-Technischen Reichsanstalt, advocates, in order to obtain a beautiful brown color on copper, 120 gm. copper sulphate and 15 gm. potassium permanganate in 1 litre of water; Beutel recommends as a "brown" bath, a solution of 25 gm. copper sulphate, 25 gm. nickel sulphate, 120 gm. potassium chlorate and 7 gm. potassium permanganate in 1 litre of water. With potassium chlorate solutions containing copper, deep black tints are obtained on cadmium as previously mentioned, so that an influence on this tint by potassium permanganate was not to be expected and therefore, only solutions containing copper sulphate and potassium permanganate of the concentrations used by Buchner and Groschuff were tested. With the composition given by Buchner, a brownish black, non-adherent color resulted, while with higher concentrations up to those given by Groschuff, tints which adhered still worse, were obtained. Better results were obtained by diluting the Buchner bath and boiling for a long time. The result of this preliminary experiment was further tested by altering the copper sulphate content keeping the potassium permanganate content constant, and then altering the permanganate content keeping the sulphate content constant, within limits of 5-20 gm. copper sulphate and 2-15 gm. potassium permanganate.

Increasing the copper sulphate percentage above 5 gm. did not improve the permanence of the resulting color. With higher potassium permanganate contents the tint became deep black, but easily peeled off. On the whole the results were unfavorable. The substitution of copper sulphate by equivalent amounts of copper chloride, gave at the higher concentrations no better results. On the other hand, in the more dilute solutions with 5 gm. copper chloride and 2.5 gm. potassium permanganate yellowish brown surface layers were obtained, while somewhat higher copper chloride contents gave reddish brown surface layers which after dry, light scratching yielded uniform and really good serviceable colors. It was shown, however, by further experiments that the use of copper nitrate is to be recommended.

On account of the better success achieved with the previously tested baths in which copper sulphate was substituted by copper nitrate, solutions containing copper nitrate and potassium permanganate were specially thoroughly tested. At quite low concentrations of the bath components, cadmium developed an iridescent brass yellow tint, after short immersion, and a weak violet iridescent brown tint after long immersion. With about 10 gm. copper nitrate and 1 gm. potassium permanganate per litre, and an immersion period of five minutes, an iridescent brown tint was obtained, longer immersion giving a flecked, spotted dark reddish brown tint. Increasing

the copper nitrate content produced a deep black tint more rapidly; increase of the potassium permanganate content similarly proved that a brown tint was not to be obtained thereby.

As a result of oft-repeated experiments, a solution containing approximately 10-15 gm. copper nitrate (0.04-0.06 molar), and 2.5 gm. of potassium permanganate (about 0.015 molar) in 1 litre of water is to be recommended for producing a brown color on cadmium. It is to be noted that, as in the case of using potassium permanganate baths for copper alloys, the concentration can vary between somewhat wide limits, and that the color varies from yellowish to reddish and greenish brown, depending upon the concentration, the time of immersion and the age of the bath. The finish comes out of the bath spotted and iridescent, and assumes a uniform brown color only after light dry scratching. In contradistinction to the chlorate bath, this bath is used at a temperature of 60-80° C. In order to produce a black color, all solutions in a not too dilute state are suitable if sufficient time of immersion is allowed. In order to reduce the time of immersion the use of a solution composed approximately of 30 gm. copper nitrate (about 0.125 molar) and 2.5 gm. potassium permanganate (about 0.105 molar) in 1 litre of water at a temperature of 60-80° C. is recommended.

In general it was more difficult to obtain a good uniform brown color than the black, since the conversion of the initially thin spotted brown color into the black took place too quickly in the course of attempts to intensify the brown tint. According to the reaction course given above, this should be ascribed to the fact that cadmium precipitates out copper much more strongly than brass, so that more sulphuric acid is liberated, which frees more oxygen from the potassium permanganate. Experiments were, therefore, made with the addition of copper carbonate (mountain blue of commerce, or precipitated from copper sulphate solution by adding soda solution) in order to neutralize the liberated sulphuric acid. The copper carbonate remains undissolved and must be kept in suspension in the bath by movement of the wares during coloring or by some other method of stirring. The coloring proceeded at a noticeably slower rate, and it was easier to obtain rich brown colors. Furthermore, this addition had the advantage that copper removed from the bath during the coloring process was again replaced by that going into the solution from the copper carbonate.

Other Brown Coloring Processes

Some few other brown coloring processes were tested in respect of their applicability to cadmium—the Ebermayer bath (nickel ammonium sulphate, copper sulphate, iron sulphate and potassium chlorate); the method of Buchner with copper and iron sulphate; and the Japanese method with copper sulphate, basic copper acetate and alum. No success was to be obtained, however, even on diluting, or by substituting the sulphate

*Part 1 was published in our issue for September, 1930.

by chloride. With the large number of such coloring baths available there is an existing possibility of altering others in a similar manner to make them applicable for coloring cadmium, but there is very little prospect of achieving noticeable advantages over the chlorate, and permanganate baths. As far as the application of both baths to the production of a black tint is concerned, the chlorate bath acts quicker; it should be used in the cold, and in general is preferable to the permanganate bath, which, however, produces a very beautiful deep black.

It should be mentioned that the baths for coloring described above depend upon the separation of copper, and that the protecting action of cadmium against corrosion, especially in the case of very thin cadmium deposits, is thereby modified even if the usual brushing with wax or lacquering over the colors can compensate somewhat this decrease of protective action. Experiments on this matter will be undertaken later.

"Lustre" Baths

To supplement the first series of experiments, the applicability of the so-called "lustre" baths was tested. These deposit thin sulphide layers producing interference colors. In the case of the best known lustre bath, a solution of lead acetate and sodium thiosulphate, lead sulphide or oxides, e.g., cuprous oxide firmly adhering to the surface of the metal to be colored, are produced. No satisfactory coloring of cadmium coated articles could be achieved with these "lustre" baths. Insofar as good adhering colors could be prepared, they were indifferent and unpleasing. The much-used solutions of liver of sulphur and other alkali sulphides employed to color copper and copper alloys do not act upon cadmium. On the other hand, serviceable brown tints can be produced by dipping into hot, rather concentrated solutions of Schlippe's salt (sodium thioantimoniate). Still deeper brown to reddish-brown colors were obtained by the much-used process with gold sulphide (antimony sulphide, antimony pentasulphide), similarly used for copper alloys. The antimony pentasulphide is ground with ammonia (or with ammonium sulphide) to a mass of consistency such that it can be painted on the articles, after which it is allowed to act some time upon them in a dry cupboard. Afterwards one brushes with a soft brush and scratches the color with the revolving brush in order to tone it down. Finally, the process is repeated.

Special Methods for Tinting Cadmium Deposits

Since, as has already been stated, colors which result from the separation of copper and other more noble metals must affect more or less the durability of the cadmium deposit, and thereby also its protecting action through the formation of local elements, except insofar as the usual lacquering or polishing or brushing with wax gives some compensation, it was decided to attempt the production of direct cadmium colors. Since cadmium nitrate on heating changes into the beautiful brown colored cadmium oxide, attempts were first of all made to make use of this tint. The samples were immersed in, or lightly damped with, cadmium nitrate solution and heated. Since cadmium melts at 321° C., the process cannot be employed. Attempts were made to produce the color on other metals, copper, copper alloys and iron, but in these instances no success was obtained in consequence of the high oxygen pressure. On heating, the cadmium nitrate puffs up so that no uniform oxide layer can be obtained, and attempts were then made to produce a thin firmly adhering cadmium oxide layer on the surface of the cadmium

coated articles, by means of various oxidizing agents. The process introduced by Groschuff for coloring copper and copper alloys with potassium or sodium persulphate in alkaline solution, failed with cadmium. No success was obtained with solutions of potassium chlorate and potassium permanganate, neither in acid nor alkaline solution. Experiments with potassium and sodium chlorate solutions of various concentrations to which cadmium salts (sulphate, chloride and nitrate) had been added similarly showed no action. On the other hand, potassium permanganate solutions with additions of cadmium salts yielded light to dark brown colors which adhered well, and could be toned down by dry scratching.

Permanganate-Cadmium Nitrate Baths

In support of the previous series of experiments with solutions of potassium permanganate and copper nitrate, solutions of 25 g./l cadmium nitrate and increasing content of potassium permanganate were first of all tested. With less than 30 g./l potassium permanganate, no color resulted. Above 30 g./l a slight blackening; with a high potassium permanganate content up to 200 g./l a brass yellow color resulted.

In the second series of experiments, solutions of 160 g. potassium permanganate (approx. molar), and increasing cadmium nitrate content were employed. With 50 g./l cadmium nitrate, a yellowish-brown color was obtained in ten minutes; with 75 g./l a rich yellowish-brown; up to 200 g./l a dark brown color which at 250 g./l took on a reddish hue. At still higher cadmium nitrate concentrations the tint again became less satisfactory and porous blackish spots appeared. The addition of cadmium carbonate to neutralize free acid did not improve the reaction.

Solutions of 160 g./l potassium permanganate and additions of cadmium sulphate gave with 100 g./l of the latter, no color; with 150 g./l a yellow hue; with 250 g. a rich gold yellow; at 350 g./l a yellowish red. Solutions of the same permanganate concentration with additions of cadmium chloride gave with 100 g./l cadmium chloride a yellow hue; with 200 g./l a spotted yellow brown; and with 300 g./l a smutty yellow-brown. The solutions with cadmium chloride additions gave only slightly utilizable colors. Solutions with cadmium sulphate additions are not so good for use as those with cadmium nitrate additions.

Solutions of potassium permanganate with additions of cadmium nitrate can, therefore, be used for the production of brass yellow to dark brown and reddish-brown colors. As in the case of permanganate baths serving for the coloring of copper alloys, very varied colors may be obtained by altering the concentration, temperature, time of action, and subsequent treatment by scratching, etc. The solutions suitable for the coloring of cadmium distinguish themselves from those used for copper alloys, however, by a considerably higher concentration despite, at least when it is a question of darker colors, the longer time required for the coloring process, and the necessity to use boiling or heated solutions. Since the use of more highly concentrated solutions leads to considerable losses in salts during rinsing of the colored wares, the potassium permanganate concentration even was not raised above one molar, although the action with twice molar solutions was better. In order to decrease the washing losses, the rinsing should take place first of all in a small vessel whose water serves to make up the liquid lost by evaporation, from the bath, and finally in running water.

Bath Compositions

The composition of the bath can vary between wide limits. Since a long immersion is not economical, one should not take the potassium permanganate concentration much below molar, i.e., 160 g./l. The cadmium nitrate concentration in order to obtain brass-yellow and bright yellow-brown tints must contain at least 50 g./l, preferably somewhat more; to obtain dark brown colors, however, at least 100 g./l, preferably 200-250 g./l should be present.

The following composition can be given for the brown bath: 160 g. potassium permanganate (approx. molar), 60-250 g. cadmium nitrate (about 0.2 to 0.8 molar according to the desired tint), 1 litre of water. The articles to be colored are immersed for ten to twenty minutes or even longer in the boiling or nearly boiling solution, to which the rinsing water is added to make up for the evaporation losses.

A noticeable difference in the depth of the brown color in two parallel series of experiments occurred when in one series the solution was heated in a porcelain basin, and in the other in an enamelled iron vessel, such as is generally used for metal coloring; experiments with the addition of iron salts initiated this since the enamel of the vessel showed itself to be damaged. With potassium permanganate solutions and additions of iron sulphate, especially, however, with additions of ferric chloride, brown and blackish-brown tints were to be obtained. Better results, however, were obtained if to the above mentioned bath of potassium permanganate and cadmium nitrate, 5-10 g./l iron sulphate or ferric chloride were added: preferably only 5 g./l of the latter, since the color very easily becomes black. With considerably more concentrated solutions of 320 g. potassium permanganate, 100 g./l cadmium nitrate and 20 g. ferric chloride, deep red-brown colors were obtained, especially on adding several drops of nitric acid.

Evening Course in Electroplating at New York City College

THE course in practical electroplating at the College of the City of New York commenced its third year on the evening of September 29th, under the personal direction of Dr. L. C. Pan. It is open to all persons interested in electroplating, metal finishing and chemical control of plating solutions. The class meets on Mondays and Wednesdays from 7 p.m. to 11 p.m., in the Chemistry Building, Amsterdam Avenue at 139th Street.

The subject matter of the course deals with the following topics:

1. Fundamental principles underlying the various operations of modern electroplating.
2. A critical study of each of the present processes and commercial practices of electrodeposition of various metals and alloys, including copper, nickel, chromium, silver, gold, cadmium, zinc, brass, iron, lead, tin and platinum.

3. Physical and chemical methods of control including simplified methods of analysis and preparation of standard reagents.

Laboratory work constitutes an important part of the course. Among the exercises to be done in the laboratory are the Faraday's law, current efficiency, determination of thickness of deposit, electrode potentials, polarization and depolarizers, metal and metal-ion concentration, addition agents, brighteners, throwing power, porosity and corrosion tests, analysis of plating solutions. The laboratory work is arranged flexibly so as to meet the individual needs of each student.

Registration may be made evenings in person or by mailing a check or money order, payable to the College of the City of New York, for \$30.50, to Walter Stalb, Bursar, College of the City of New York, 140th Street and Convent Avenue.

Lead on Steel

Q.—We have been using for some time the fluoborate solution for lead plating steel as outlined in the transactions of the American Electrochemical Society, 1919, page No. 243.

It has been brought to my attention that another solution has proved more satisfactory, namely one which is operated by 50 per cent lead and 50 per cent tin anodes after the fluoborate has been electrolyzed by these same anodes.

The reference in this above method is quoted as being transactions of the American Electrochemical Society, 1921, page No. 287.

I am very interested to know if there is any marked advantage in using this second method and also what your experience has been with it.

A.—The deposition of a lead-tin alloy has been successfully done by the United States Navy Dept. in torpedo tubes. The process is described in detail in the Transactions of the American Electrochemical Society, Vol. 40, p. 147, 1921, in an article by Dr. William Blum and H. E. Haring. A brief description can be found in Prin-

ciples of Electroplating & Electroforming by Blum and Hogaboom, revised edition, p. 377. We have had no personal experience with this process but know that it is a practical one. You will have to decide whether it is applicable to your requirements.—G. B. H.

Cleaning Polishing Wheels

Q.—One of the large users of polishing wheels called us here today and wanted to know if we had ever heard of a steam wheel cleaning machine; something that will remove worn-out coating on the face of polishing wheels. I have seen some comment on a proposition of that kind but at this writing I cannot tell who the maker of it is or who the experimenter was. Perhaps you would know. I will be glad to hear from you if you have any information to impart on the subject.

A.—Wheels that have an abrasive glue coating can be cleaned by using a stream of high pressure steam. A pressure of not less than 60 lbs. is necessary and this is directed against the face of the wheel. The glue and abrasive are removed in a short time. G. B. H.

Burnishing and Nickel Plating Kitchen Utensils

Such as Spoons, Egg Separators, Egg Beaters, Turners, Strainers, Ladles, Etc., Made of Steel; Also Ball Burnishing Stainless Steel Articles

By T. C. EICHSTAEDT

Foreman Plater

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

MUCH has been written on the subject of ball burnishing and there is much yet to be written. Most of the articles the writer has read, have been good but lacked detail. One article says "We run them an hour," another says, an hour and a half, and still another states that he runs his three hours. But not one of them has given the speed of the barrel, the composition of the solution, the size of balls, the kind of cleaning solutions before burnishing, the handling of the work after the burnishing operation, or the capacity of the burnishing barrel. These are all very important factors in getting results.

Factors in Ball Burnishing

My contention is that almost any of the above articles can be burnished in one hour with the proper speed of barrel, the proper solution in the barrel and the right amount to a load. (The last mentioned factor of load is the most important.) The correct proportion of balls to a load is vital and also the correct size of balls or cones to suit the kind of work to be burnished. The speed of the barrel should be between 28 and 32 R.P.M. Some have an idea that the faster the better, but I find that I get best results between 28 and 32 R.P.M.

The load all depends upon the size of barrel. I always have my barrels loaded about 4/5 full of material and balls (approximately twice as many balls as material to be burnished). If the barrel will hold 3 bushels of work and balls then I would put in 2 bushels of balls and 1 bushel of material to be burnished.

The size of the balls has to be governed by the size and shape of the article to be burnished. If there are no small ledges on the work and it is plain, oval or even flat, then the 1/4" ball is the best for most purposes. I have also found that one size of ball works with better efficiency than mixed ball sizes. If there are sharp corners or ledges on the articles, then it is well to mix cones with the balls.

The lining of the barrel is generally of maple wood. While this is absolutely essential where nickel plated or brass work is being burnished, I have had good success with a steel lining made of boiler plate, a cylinder fitting the inside of the cast iron barrel with 3 or 4 one inch angle iron ribs on the inside to keep the balls and material from just sliding around.

Burnishing Solution

The solution for the burnishing barrel is made up of the following proportions for a 55-gallon barrel.

Dissolve 12 1/2 pounds soda ash, 25 pounds soap chips, and 3 pounds cyanide; mix in a barrel and let cool. Then to every load of the burnishing barrel use 1 quart by measure of the mixture. This is sufficient and very economical. It is good for either steel, stainless steel or brass work. The time for all my work is one hour.

Barrel Plating

If work is to be nickel plated, it is never dried until after nickel plating, but is run through a cleaner, boiling hot, then water rinse, then sulphuric acid 8 ozs. to a gallon, then cold water rinse, then cyanide 8 ozs. to a

gallon; rinse through 2 cold waters and into plating barrel. Plating barrel runs 4 to 6 R.P.M. Solution, 6 ozs. metal, 3 ozs. chloride, 2 ozs. boracic acid, pH about 5.8-6. Plate 1 hour at 6 volts or 12 if you have it. If 12 volts, you can reduce the time. After nickel plating, the work is rinsed in cold water, placed in burnishing barrel and burnished for a time depending upon the shape and the brightness desired, etc., for 20 minutes to 1 hour. No work should be run over 1 hour after nickel plating.

After burnishing nickel plated work it is rinsed in cold water and hot water with a little fig soap in it, and dried in a sawdust barrel, preferably a steam jacketed steel barrel. Run not over 24 R.P.M. and preferably about 20 R. P. M. Then riddle out and the work is ready for stock room or chrome plating.

Burnishing Stainless Steel

The stainless steel work, of course, needs no plating and should be handled carefully after burnishing so as not to have it stain before drying. Sounds fishy? Maybe. But stainless steel once stained in process must be burnished again to get the stains off again. I have found no other way of doing it.

Flat pieces, such as turners and cupped pieces such as spoons and ladles should have a wire put in them in order to keep them from rusting and the flats from sticking together. The materials I have written of in this article are of A-1 smooth steel and also smooth stainless steel. It does not pay to work any other kind in either roughing or burnishing barrels as the cost of the smooth is not enough more than the rough to offset the cost of rough tumbling, etc., and very often the rough steel will never take a finish especially now that so much of the work is to be chrome plated. Even in brass plating it has been found that most of the spotting out on steel stampings, that were burnished, is due to imperfections in the steel, which could not be seen after burnishing.

The cleaner mentioned is any good heavy duty cleaner without resin, strong in caustic, 8 ounces to a gallon generally, and the work agitated in baskets by power mechanically. The best I have found is a steam jacketed steel tumbling barrel. Clean a load as it is needed and dump the cleaner each time.

All material should be clean before placing in the burnishing barrel, otherwise the balls will become dirty and a little oil or grease will interfere with the burnishing of many materials. And then too the balls will have to be cleaned and the barrel also and this takes time and delays production.

Some seem to think that the balls should be cleaned every week or at stated times. This is not necessary if they are kept clean and they will keep themselves clean if the work is all cleaned before going into the burnishing barrel.

After the balls and material and soap are placed in the barrel it is then filled with cold water and closed up and started. I have not mentioned any particular makes of burnishing barrel. There are, of course, special advantages for certain of them on certain shapes and sizes of materials.

Standards for Copper Alloy Ingots

Revised Tentative Specifications for Copper Base Alloys in Ingot Form for Sand Castings, Approved as Tentative by the American Society for Testing Materials on August 12, 1930 and by Non-Ferrous Ingot Metal Institute on September 5, 1930

At a meeting of the Non-Ferrous Ingot Metal Institute on September 5, 1930, formal approval was given to the revised specifications for Copper Base Alloys in Ingot Form for Sand Castings, that were unanimously approved last month as tentative by American Society for Testing Materials Committee E-10 on Standards. In approving these specifications, the membership of the Non-Ferrous Ingot Metal Institute obligated itself to promote and encourage in every possible manner the use of such specifications in every instance where such specifications could be properly used.

The formulation and approval by the American Society for Testing Materials of these tentative specifications was the direct outgrowth of a survey made by Non-Ferrous Ingot Metal Institute in 1929 which showed that during the preceding calendar year, some 600 different specifications for ingot brass and bronze had been received and served by the members of the Institute. For the popular 85-5-5 alloy alone, forty different specifications had been requisitioned in 1928.

In the interests of improved utility to the foundry and of economy to the manufacturer of copper alloys in ingot form, it was recognized that existing specifications should be revised in accordance with current needs and that vigorous efforts should be made to encourage the use of standard specifications. As the revised specifications are the result of over a year's effort by an A. S. T. M. committee composed of some of the best technical and practical minds among foundrymen, smelters and trade press editors, it is to be assumed they will be received and used with confidence by present and prospective users of ingot brass and bronze.

Several months ago, the Institute sponsored and is now financing an investigation at the U. S. Bureau of Standards into the physical properties of the alloys represented by the various specifications that are now adopted. This research will be continued in the belief that the findings will be of substantial value in making further refinements and possible additions to the specifications just approved.

The full text of the tentative specifications as approved by Non-Ferrous Ingot Metal Institute is as follows:

1. These specifications cover brass ingot metal for sand castings in fifteen different compositions, regularly sold by the trade and arbitrarily herein given numbers one to fifteen inclusive to differentiate them from one another. These numbers have no other significance.

Manufacture

2. The manufacturer shall use care to have each lot of ingot metal as uniform in quality as possible. This metal may be manufactured by any refining process which will yield a satisfactory quality of product.

Chemical Properties and Tests

3. The alloys shall conform to the requirements as to chemical composition given in Table I, within the limits specified in Table I. (Tables will be found on page 480.)

Note.—The limits specified in Table I indicate the maximum and minimum percentages within which variations of different elements shall be permitted, with the understanding that every precaution shall be taken both

in the selection of raw materials as well as methods of manufacture to insure that the resulting ingot metal will come within these specified limits.

4. (a) Ten ingots shall be selected by the inspector to represent each 40,000 pounds and five ingots shall be selected for less than carload lots.

(b) The samples for chemical analysis may be taken either by sawing, drilling or milling the ingots and shall represent the average cross-section of all of the ingots selected for sampling.

(c) The saw, drill, cutter or other tool used shall be thoroughly cleaned. No lubricant shall be used in the operation and the sawings or metal chips shall be carefully treated with a magnet to remove any particles of steel introduced in taking the sample.

5. The chemical analysis shall be made in accordance with the Standard Methods of Chemical Analysis of Brass Ingots and Sand Castings (A. S. T. M. Designation: B 45) of the American Society for Testing Materials.¹

6. The designating mark of the manufacturer, the proper lot number, and the numerical designation of the alloy supplied shall be marked on each ingot for identification.

Inspection and Rejection

7. (a) Inspection may be made at the manufacturer's works, where the ingots are made, or at the point at which they are received, at the option of the purchaser.

(b) If the purchaser elects to have inspection made at the manufacturer's works, the inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the material ordered. The manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy him that the material is being furnished in accordance with these specifications. All tests and inspection shall be so conducted as not to interfere unnecessarily with the operation of the works.

8. If the test ingots selected to represent a lot fail to conform to the requirements specified in Section 3 all ingots in such lot shall be rejected.

Claims

9. Claims, to be considered, shall be made in writing within 30 days of receipt of material at the purchaser's plant and the results of the purchaser's tests shall be given. The manufacturer shall, within one week of receipt of such claim, either agree to satisfy the claim, or send a representative to the purchaser's plant to resample the shipment in accordance with Section 4. Samples so taken shall be sealed and submitted to a mutually agreeable umpire whose determinations shall be final.

10. The expense of umpire analysis shall be paid by the loser or divided in proportion to the concession made in case of a compromise. In case of rejection being established, the damages shall be limited to the payment of freight both ways by the manufacturer for the substitution of an equivalent weight of ingot metal conforming to these specifications.

¹1927 Book of A. S. T. M. Standards, Part II, p. 724.

TABLE I—TENTATIVE SPECIFICATIONS FOR STANDARD COPPER BASE ALLOYS

ALLOY GRADE NO.	COP- PER, PER CENT	LEAD, PER CENT	TIN, PER CENT	ZINC, PER CENT	IMPURITIES, MAXIMUM, PER CENT							TOTAL CONSTIT- UENTS OTHER THAN COPPER, LEAD, TIN, ZINC, NICKEL	TOTAL CONSTIT- UENTS OTHER THAN COPPER, LEAD, TIN, ZINC, NICKEL, ANTI- MONY
					ANTI- MONY	IRON	NICKEL	PHOS- PHORUS	SUL- PHUR	ALUM- INUM	SILI- CON		
1	Remainder	1½-2½	9-11	1½-2½	0.25	0.25	0.50	0.03	0.08	0.005	0.05	0.50	...
2	"	1½-2½	7¼-8¾	3½-4½	0.25	0.25	0.50	0.03	0.08	0.005	0.05	0.50	...
3	"	4¼-5¾	5¼-6¾	2½-3½	0.25	0.25	0.50	0.03	0.08	0.005	0.05	0.50	...
4	"	4¼-5¾	4¼-5¾	4¼-5¾	0.25	0.25	0.50	0.03	0.08	0.005	0.05	0.50	...
5	"	4¼-5¾	3¼-4¾	9-11	0.25	0.35	0.50	0.03	0.08	0.005	0.05	0.50	...
6	"	7-9	2½-3½	8½-11½	0.25	0.35	0.50	0.03	0.08	0.005	0.03	0.50	...
7	"	9-11	9-11	1.00a	1.00	0.25	0.50	0.05	0.08	0.005	0.03	...	0.50
8	"	9-11	9-11	2.00a	1.00	0.25	0.50	0.05	0.08	0.005	0.03	...	0.50
9	"	13½-16½	7-9	2.00a	1.00	0.25	0.50	0.05	0.08	0.005	0.03	...	0.50
10	"	18-22	5¼-6¾	1.50a	1.00	0.25	0.50	0.05	0.08	0.005	0.03	...	0.50
11	"	14-20	3½-5½	4-6	1.00	0.25	0.50	0.05	0.08	0.005	0.03	...	0.50
12	70-75	1-4	2.00a	Rem.	0.10	0.25	0.50	0.01	0.05	0.005	0.10	0.50	...
13	67-70	1-4	1.50a	"	0.10	0.30	0.50	0.01	0.05	0.005	0.10	0.55	...
14	64-67	1-3	1.00a	"	0.10	0.35	0.50	0.01	0.05	0.005	0.10	0.60	...
15	60b	3.00a	1.00a	"	0.10	0.35	0.50	0.01	0.05	0.50	0.10	1.00	...

a Maximum. b Minimum.

APPENDIX

The data in the following tables do not constitute a part of these specifications. They are given merely to indicate to the purchaser the physical properties of the various alloys specified which can be expected of carefully manufactured alloys of the formulae indicated, and to constitute a guide to the purchaser in selecting the grade best suited for meeting the service condition for which the ingot metal is to be used.

ALLOY GRADE NO.	TENSILE STRENGTH, LB. PER SQ. IN.*	ELONGATION IN 2 IN. PER CENT	REDUCTION OF AREA, PER CENT	COMPRESSION DEFORMATION LIMIT, LB. PER SQ. IN.†	BRINELL HARDNESS (500 KG. FE.- 30 SEC.)	SHRINK- AGE, IN. PER FT.	WEIGHT, LB. PER CU. FT.
1	32,000-38,000	15-20	15-20	.....	55-65	0.125	535
2	30,000-36,000	25-30	25-30	.....	55-65	0.125	535
3	25,000-33,000	15-20	15-20	.....	45-60	0.140	535
4	27,000-33,000	15-20	15-20	.....	50-60	0.140	535
5	29,000-35,000	25-35	20-30	.....	40-50	0.140	535
6	22,000-28,000	10-15	10-15	.....	50-55	0.125	540
7	27,000-33,000	7-12	8-13	12,500	47-52	0.25	553
8	27,000-33,000	7-10	7-12	12,500	47-52	0.25	553
9	25,000-30,000	11-17	10-16	12,000	45-50	0.25	570
10	22,000-27,000	10-16	7-13	11,000	42-47	0.25	570
11	25,000-30,000	10-15	7-13	12,000	47-52	0.25	570
12	30,000-35,000	35-45	25-35	.....	40-50	0.125	535
13	30,000-35,000	25-35	20-30	.....	40-50	0.125	534
14	30,000-35,000	25-35	20-30	.....	40-50	0.125	533
15	30,000-45,000	15-25	20-30	.....	40-50	0.20	500

*The tension tests were made on test specimens taken from ingot. Sand cast specimens would show somewhat lower values.

†The compression tests were made on machined test specimens (sand castings) of 1 sq. in. sectional area, 1 in. high. The compression deformation limit is taken as the load producing a compression in the specimen of 0.001 in. At the request of committee B-2, on non-ferrous metals and alloys, committee E-1 on methods of testing is giving consideration to revising the dimensions of compression test specimens and the method of determining the so-called "compression deformation limit." The revision of the values in this column, on the basis of cylindrical specimens 1 sq. in. in sectional area and 3 in. high is contemplated. A revision of the methods of determining compression information limit is also under consideration.

ALLOY GRADE NO.	EXAMPLES OF USE	FOUNDRY MANIPULATION	CHARACTERISTICS
1	Commercial bronze for general service	Easily handled	Machines well
2	High pressure steam fittings	Easily handled	Machines well
3	Steam fittings subjected to moderate pressure	Easily handled	Machines well
4	High grade red brass for general service	Easily handled	Machines well
5	Reddish yellow alloy for air, gas and water fittings	Not difficult	Machines easily
6	Valve fittings for low pressure	Not difficult	Machines very easily
7	Bearings for heavy pressure (may later be eliminated in favor of No. 8)	Not difficult	Machines easily
8	Bearings for heavy pressure (lower cost than No. 7)	Not difficult	Machines easily
9	General service bearings	Not difficult	Machines easily
10	Bearings operated at high speed and under light or medium pressure	Not difficult	Machines easily
11	Car journal bearings and similar service	Not difficult	Machines easily
12	Yellowish red alloy for plumbers' fittings	Not difficult	Machines easily
13	Yellow brass for light castings and ornamental work not requiring strength or subjected to internal pressure	Not difficult	Machines easily
14	Yellow brass for heavier castings	Not difficult	Machines easily
15	Plumbers' flanges, scupper pipes, etc.	Very difficult. Aluminum up to 0.30 per cent improves casting properties, but increases shrinkage.	Hard to machine. Not suitable for bearings or water pressure fittings.

THE METAL INDUSTRY

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Edition this Month, 6,500 Copies. Buyers Guide, Advertising Page 83.

Editorial

The Business Situation

ANOTHER report has been published by the National Survey Conference in Washington, D. C., on the business conditions in the United States. Briefly, the summary which is separated into the specific trades and industries, shows the following tendencies.

Installment financing is lower than last year. Construction of public works and utilities are ahead of 1929; non-residential building, behind, and residential building still further behind. Plumbing and heating supplies are 60 per cent behind last year's volume. Employment in ship yards is increasing. Railroad construction has been about 34 per cent above that of last year. Radio manufacturers report business on the upgrade. Electrical power construction is exceeding the estimate made last December, which was in advance of the program for the previous year. Copper and zinc production for August was 30 per cent of August, 1929. Steel ingot output in August was 5.5 per cent higher than in July, the first increase since February. Automobile production in August was 54.6 per cent under August, 1929. Commercial airplanes produced up to August, 1930, were slightly less than one-third of those produced in the same period of 1929.

The machine tool industry operated in August at about 60 per cent capacity, but the inquiries increased sharply. Hardware operations increased somewhat in August over July, and September is holding the improvement but without reflecting the full normal seasonal increase. The chemical industry advanced during August and early September. Electrical equipment fell off during the summer months with business in August, for the first time in the year, under the corresponding month of 1928. The textile industry increased about 3 per cent over July. Department store sales were about 8 per cent less in August, 1930, than in August, 1929. Exports in August were 11.5 per cent higher than in July, but 23.3 per cent below August, 1929.

A survey of world business conditions shows indications of improvement in seven of the 17 countries covered.

The story today seems to be that there is a tendency toward a seasonal rise. That this rise is not what was hoped for is becoming more and more clear daily. The New York Stock Market giving, as usual, exaggerated evidence to that effect. That there will be some sort of a fall rise, seems to be generally accepted, but so far it has been slow and disappointing in extent. Extreme caution is being exercised, undoubtedly to a greater degree even than is required in such cases.

The brighter side of the picture is the fact that depression has already lasted a year and is due to turn the corner. This guess is dictated not only by hopes but by past experience, our memories of 1921 pointing to such a turn. Business is better, but not so much better as one would wish to see it. In our disappointment at not realizing our over-optimistic hopes, we should not go to the extreme of seeing only darkness where light is ahead.

National Metal Week

THE great metal meeting of the year has been held in Chicago by a group of co-operating technical societies, headed by the Steel Treathers and with the Institute of Metals Division as one of the important groups. The report published on page 459 of this issue shows how comprehensive was the scope of the non-ferrous papers delivered as they covered die castings, aluminum alloys,

x-rays, metallography, tungsten carbide, copper alloys and aluminum bronze.

It was a meeting of technical and laboratory men whose work is now recognized to be a forerunner of improvements in the plant. It is these men who develop new alloys and processes, who control methods of manufacture, under whose direction incoming materials and outgoing products are kept up to standard. The metal industries have recognized the importance of technical control and the indispensability of trained supervision.

The exhibition covered everything from furnaces to microscopes. They were instruments of precision, instruments of control and instruments of production. For we must remember that the laboratory technician is not a cloistered recluse interested only in abstractions. He is the one to take his findings and translate them into practical operating directions for the foundry and manufacturing superintendent to put into operation. His province is research and investigation but always with the knowledge that his findings must be put to practical use.

National Metal Week has now become one of the most important annual features of the year. Those who possibly can, attend them, and those who cannot, read avidly the reports of the sessions.

Metals Decide the Yacht Race

THE result of the yacht race between the Shamrock V and the Enterprise for America's cup was a disappointment we believe, not only to Sir Thomas Lipton but to most Americans. The Enterprise could do not less than its best, of course, but most of us would have been quite satisfied if the famous sportsman had been able to gain one race at least. But it was the old story of hand work against machinery, the foot runner against the bicycle, and the horse against the automobile. The Shamrock was a first rate boat commanded by an excellent crew, but the Enterprise was the last word in modern improvements in labor saving devices to save the time and efforts of the crew, and last and probably most important, in the use of metals to add strength and save weight.

The outstanding novelty in its design was, of course, the Duralumin mast which was 1500 pounds lighter than that of the Shamrock V, and at the same time capable of bearing more stress and a greater area of canvas than a wooden mast of the same dimensions. It was far more expensive, of course, but with characteristic American dash the expense was absolutely ignored. Duralumin, a comparatively high priced alloy composed of 4 per cent copper, and small amounts of magnesium and manganese with the balance aluminum, subject to heat treatment and ageing was, we believe, the largest single factor in the difference in design between the two yachts. Other metal parts of the Enterprise were its bronze plates which were rolled in Ansonia, Conn., and its Monel metal fittings which were used because of their high strength and resistance to corrosion.

Sir Thomas's last comment on the race was, "It is impossible to beat that mast," referring to the duralumin stick of the Enterprise. He said that he might come again. Perhaps he will have enough metals of the right sort in his next boat to lift the coveted cup.

Sir Thomas will go back without America's cup but with other honors which may console him. He has been presented by the city of Newport with a silver replica of the Old Stone Mill, a famous landmark in one of its

parks. He will also be presented with a loving cup paid for by popular subscription throughout the country. We know that these souvenirs will show him that he has gained something in America more valuable than the cup he came to win.

Fewer and Better Foundries

THE tendency throughout industry in the United States for the past decade has been toward higher production with the same or less labor, by the use of improved equipment. The foundry industry has been no exception to the rule, having taken up material-handling machinery, larger, better and faster furnaces and improved molding methods and equipment. This is made clear by a census of foundries recently published in Penton's Foundry List, showing that foundries have decreased in number since 1928, but are producing larger tonnages of castings. For example, there were 3341 non-ferrous foundries in the United States and Canada in 1930 as against 3547 in 1928. Exclusive non-ferrous foundries (not in the same plant as iron or steel) totalled 1479 in 1930 as against 1495. Non-ferrous departments of iron and steel foundries were 1862 against 2052. Aluminum foundries or plants melting aluminum decreased from 2655 in 1928 to 2499 in 1930.

These figures do not mean that output has fallen off correspondingly. The fact is that foundry production in 1929 was higher than ever before in its history, and this with the number of plants decreasing.

Centers of brass, aluminum and other non-ferrous metal foundry work are in the main unchanged. Chicago still leads with 98; New York follows with 89. After them come Cleveland 72, Detroit 66, Philadelphia 56, Los Angeles 48, and so down the line, Kalamazoo with 10 brass foundries, 44th on the list. Important changes were the rise of Los Angeles from 39 to 48 foundries with consequent improvement in its position on the list and the jump of Indianapolis from 9 to 18 foundries.

There seems to be no doubt that the trend in brass and aluminum foundries is toward larger units, better handled and better equipped.

Standards for Ingot Metals

THE non-ferrous ingot metal trade has had more than its share of troubles in the past few years, both technical and financial. Its financial troubles are understandable as they are part of the general business situation. The technical troubles, however, are an undeserved inheritance from the days when rule of thumb was the rule of the trade.

This condition has been the point of attack of several trade and technical organizations for the past two or three years, and one of the most important results of their efforts has recently been achieved in the publication by the American Society for Testing Materials of tentative specifications for copper and its alloys in ingot form for sand castings. These specifications (published on page 479 of this issue) have the approval of the Non-Ferrous Ingot Metal Institute a leading trade body.

Consider for a moment that there were 599 copper base ingot alloys being sold by the ingot metal manufacturers. There were 40 different specifications for the well known 85 copper, 5 tin, 5 lead, 5 zinc alloy. There were no standards of purity or quality. There were no physical requirements. As a result it was impossible to compare prices or to be sure of what was being bought.

The new tentative specifications for copper alloy ingots total only 15 in number, varying from about 60 to 90 per cent copper with specified quantities of lead, tin and zinc. Definite tolerances are stated for the percentages. Definite

maxima are given for the impurities such as antimony, iron, nickel, phosphorus, aluminum, silicon, etc. Definite physical properties are listed, such as tensile strength, elongation, compression deformation, Brinell hardness, shrinkage and weight per cubic foot. In addition, information is included on best uses for each of these 15 alloys, ease of foundry manipulation and machining characteristics.

We commend these standards to the foundry and ingot metal trades. They are still tentative and are open to suggestions from manufacturers and users, but no sounder or more progressive step could be taken than to work under such a set of standards, in the interests of both producers and consumers.

Government Aids Metal Exports

TO those who are not acquainted with the specialized work of the Government in its aid to industry, it will be news that the Bureau of Foreign and Domestic Commerce spending less than \$5,000,000 a year or one-tenth of one per cent of the total appropriated by Congress, has, as its primary purpose, the fostering and development of international trade for American manufacturers of metal and metal products of which there is an exportable surplus, and to aid importers and consumers in locating foreign sources of raw materials of which the domestic output is inadequate.

The machinery of the Bureau consists of various divisions from which specialized information can be obtained. In the division of Commercial Intelligence for example, lists are being revised and enlarged of foreign firms and agents which are in the market for particular commodities together with reliable information about these firms. The Division of Commercial Laws collects information about foreign commercial practices, patents, trade marks and copyrights, and gives advice on adjustments, commercial disputes, credits, etc. Information is also available through different divisions, on financial conditions in different countries, foreign tariffs, regional information, such as current developments which affect the sale of American products, statistical information and transportation data covering packing, shipping rates, etc. To those manufacturers whose products lend themselves to export, no better step could be taken than to get the basic information from the Bureau of Foreign and Domestic Commerce as a first step in developing trade abroad.

Metal in Roads

THE first highway has been built with an iron base. One hundred and fifty feet of experimental pavement with an Armco ingot iron base and curb were constructed on the Grand Avenue connection near Springfield, Ill. The iron base consists of three 50 ft. sections, one being blue annealed flat sheets and the other two, galvanized and corrugated. The sheets are joined by spot or tack welding on the top. This iron base is laid on a carefully rolled and subgrade. On the iron will be placed a mastic sand cushion and then 2½" or 3" of brick with asphalt filler. It is claimed that this experiment should develop an indestructible base with a smooth riding surface built into the structure with sufficient flexibility to meet all changes in temperature without breaks or cracks. It is expected that the success of this experimental stretch will open outlets for large tonnages of iron.

One of the experimental sheets used was galvanized or zinc coated and if the experiment is successful, this will prove no small outlet for zinc. Can the manufacturers of other metals think of ways in which their products can be used? It is a "long pull" idea, as tests of roads must run over a period of years, but it is eminently worth while to get aboard such a large band wagon.

Correspondence and Discussion

Good Information to a Stranger

To the Editor of THE METAL INDUSTRY:

I wish to thank you for the technical information you gave me recently. It is indeed a pleasure to know such good fellows who are so willing to give good information to a stranger from afar. Chicago, Ill.,
August, 1930.

W. F. FIELDGATE.

Re-Cutting Files

To the Editor of THE METAL INDUSTRY:

I notice an article on page 369 of your August, 1930, issue, "Re-Cutting Files." You will find the following method excellent for such work:

Wash files in strong cleaning solution, then brush with wire brush. Place in shallow acid-proof tray containing a solution of one part 38° nitric acid and one part 66° sulphuric acid, to eighteen parts water.

Lay the files in the solution, placing very narrow strips of wood under the ends of each file so that solution can reach all sides of files. Fine files will be renewed thus in 8 to 10 minutes; medium files in 10 to 15 minutes; coarse files in 15 to 20 minutes. Files

can be re-cut thus from four to five times before discarding. I re-cut from 1,000 to 1,500 files each month in our plating department, and the filers claim they cut better and in some cases last from four to five times as long as new files. I use a stoneware tray 20 by 24 inches in area and 3½ inches deep.

Doing the work is very profitable if large quantities are handled.

Syracuse, N. Y.,
August, 1930.

PAUL C. KRAMASCIK.

Appreciates Generator Data

To the Editor of THE METAL INDUSTRY:

We certainly want to thank you for the kind reply you have sent us to our recent inquiry for information regarding a generator to be used for chromium plating. This information is very instructive, and we hope that we will be in position to do some plating with our equipment.

Again thanking you for the prompt attention given our inquiry, we are, yours very truly,

Augusta, Ky.,
September, 1930.

THE F. A. NEIDER COMPANY.
W. T. Asbury, Manager.

Technical Papers

Unemployment and Monetary Fluctuations. The International Labour Conference, Geneva, Switzerland.

This is a report presented to the 12th session of the International Labour Conference in May and June, 1929. The core of the report is contained in the following excerpts.

"Unstable conditions of employment follow from the alternate rise and fall in the general price level."

"Fluctuations in the purchasing power of gold are indisputably a cause of unemployment."

Copies of this report can be obtained from the Stable Money Association, 104 Fifth Avenue, New York.

Safety Literature, issued by the National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

The Safety Man in Industry. Pamphlet No. 84.

Teaching Safety to New Employees. Pamphlet No. 65.

Industrial Housekeeping. Pamphlet No. 45.

State Safety Requirements in Industry. Pamphlet No. 94.

Protective Clothing. Pamphlet No. 16.

Determination of Aluminum and Magnesium in Zinc Base Die Casting Alloys. By Charles M. Craighead. Pennsylvania State College, State College, Pa. Industrial and Engineering Chemistry, Analytical Edition, April 15, 1930, pages 188-190.

Various methods applicable to the separation of aluminum and zinc in zinc base die casting alloys are discussed. The mercury cathode is suggested as a rapid and accurate method for the determination of aluminum and magnesium in zinc base die casting alloys, and the results obtained by this method are recorded.

Abstracts of Scientific and Technical Publications from the Massachusetts Institute of Technology, Cambridge, Mass. 99 pages, 6 x 9; paper covers. The July issue, covering January 1-June 30, 1930. Includes abstracts of doctors' theses. Also, January issue, 45 pages.

Five Years of Research in Industry—1926-1930. A reading list by Clarence J. West. National Research Council, 29 West 39th Street, New York. 91 pages, 6 x 9; paper covers. Excellent bibliography.

Polytechnic Institute of Brooklyn, N. Y. Bulletin of the Evening Session. 82 pages, 6 x 9; paper covers. Also Bulletin of Graduate Courses. 32 pages, 6 x 9; paper covers.

Relationships Between Rockwell and Brinell Numbers, by

S. N. Petrenko, Bureau of Standards, Department of Commerce. Sold by superintendent of Documents, Washington, D. C., for 10 cents. 50 pages, 6 x 9; paper covers.

Comparative Rockwell and Brinell tests were made on a great variety of ferrous and nonferrous metals.

Two equations were used as guides in finding empirical formulas which fitted most closely the values determined experimentally. Of all the experimental values obtained in this investigation very few differed by more than 10 per cent from values obtained from these empirical equations.

Empirical equations were also found giving the tensile strengths of steels in terms of their Rockwell numbers. Experimental values checked these equations within an error of plus or minus 15 per cent.

Government Publications

Government publications are available from the Superintendent of Documents, Government Printing Office, Washington, D. C., to whom proper remittance should be made to cover price where a charge is mentioned. In some cases, application should be made to the governmental body responsible for the publication; in such cases this is indicated.

Recovery of Metals from Secondary Sources in 1929. Department of Commerce. 4 page circular.

Brass or Bronze Pipe Fittings, 125 Pound, Threaded. Federal Specifications Board, Washington, D. C. Resubmission of proposed federal specification. Copies obtainable from Board.

Lead in 1928 (General Report). By Elmer W. Pehrson, Bureau of Mines, Department of Commerce. Price, 10 cents.

Die-Head Chasers. (For self-opening and adjustable die heads.) Simplified Practice Recommendation R51-29, Department of Commerce. 10 cents.

Metal and Mineral Information Circulars. Issued by Bureau of Mines, Department of Commerce, Washington, D. C., as follows:

Selenium and Tellurium, by R. M. Santmyers. No. 6317.

Cobalt, by Paul M. Tyler. No. 6331.

Tantalum (and Columbium), by E. P. Youngman. No. 6328.

Radium, by Paul M. Tyler. No. 6312.

Monazite, Thorium and Cerium, by R. M. Santmyers. No. 6321.

Shop Problems

This Department Will Answer Questions Relating to Shop Practice.

ASSOCIATE EDITORS

Metallurgical, Foundry, Rolling Mill, Mechanical

H. M. ST. JOHN
W. J. REARDON

W. J. PETTIS
P. W. BLAIR

Electroplating, Polishing, and Metal Finishing

O. J. SIZELOVE A. K. GRAHAM, Ph.D.
G. B. HOGABOOM WALTER FRAINE

Blue Black on Steel

Q.—We enclose a piece of drawn wire and would kindly ask you to let us know the process of the blue dip.

Also, please let us know the blue dip the hardware people use on screws, nails and cheap goods.

A.—The black finish on the sample submitted is known as a gun-metal or carbonia finish and is used extensively on small parts such as buttons, pen points, typewriter parts, etc.

To apply the gun-metal or carbonia finish, the work is placed loosely in a retort with a small amount of charred bone and heated to between 700 and 800 degrees Fahrenheit. After the articles are thoroughly oxidized, the temperature is allowed to drop to about 650 degrees Fahrenheit, when a mixture of bone and carbonia oil is added. Heating is then continued for a period of several hours. When the work comes from the retort it is a dull grayish-black, and by dipping in sperm oil or tumbling in oily cork a uniform black finish is secured.

Various types of black finish can be secured. These depend principally upon the finish of the part before the special treatment is given. Cold drawn or highly polished parts will take a glossy black finish. Parts made from ordinary stampings will have a somewhat duller finish, while work which has been sand blasted prior to applying this treatment will have a black matte-like finish. While not entirely rust preventive, this finish acts as a retardant to the formation of rust.

To produce a blue finish on screws, nails, etc., place some sodium nitrate in an iron pot and heat to approximately 700 degrees Fahrenheit; cleanse work of all grease and put into the kettle thoroughly dry. A few seconds will be sufficient to produce the color. Plunge the work into cold water, dry, and coat with sperm or paraffine oil. Small work may be tumbled in sawdust dampened with oil.

W. F., Problem 4,012.

Bright Nickel

Q.—Will you kindly give us a formula so that we can get a bright nickel finish by electric barrel tumbling on small brass ornaments. Nickel should look almost like silver.

A.—Formula for nickel solution:

Double nickel salts.....	8 oz.
Single nickel salts.....	8 oz.
Sodium chloride	4 oz.
Boric acid	2 oz.
Water	1 gallon

For a brightener for this particular solution, we would suggest that you use cadmium chloride. Dissolve one ounce of cadmium chloride in one quart of water and add a small quantity at a time until the desired brightness is obtained. The amount to be added will depend upon the volume of solution the tank contains, but, as a guide, one fluid ounce of the cadmium solution should be sufficient for each 10 gallons of nickel solution. An excess should be avoided as it causes a brittle deposit. If too much gets in, a high current density will soon remove the excess.

O. J. S., Problem 4,013.

Chromium Exhaust Drippings

Q.—We are sending you a sample of drippings from the exhaust system of our chromium tank. We would appreciate it if you would analyze this for its purity and give us your advice as

to whether we could use this solution. Perhaps due to its possible high content of iron and other impurities, it should be thrown away.

A.—Analysis of solution:

Chromic acid	53.28 oz.
Trivalent chromium	1.33 oz.
Metallic iron	0.16 oz.
Sulphates	0.23 oz.

The impurity that would do the most harm to the chromium solution is the trivalent chromium content. We would not suggest that it be added to the solution. It should be discarded as is

O. J. S., Problem 4,014.

Fire Gilding

Q.—We are interested in having some metal parts plated with gold by the fire gilding process. We believe you may be familiar with the process and able to inform us of the name and address of a firm who might be able to do such work for us.

A.—Fire gilding is carried on by very few concerns at the present time. This process has been superseded by electrodeposition of gold. Military button manufacturers are probably the only ones doing fire gilding, and we would advise you to apply to some of the larger of such concerns.

G. B. H., Problem 4,015.

Gas Holes in Bronze

Q.—We are sending you a sample of a bushing consisting of 60 per cent copper, 25 per cent nickel, 10 per cent zinc, 2 per cent iron, 2 per cent tin, and 1 per cent lead. We used a boronic alloy for a deoxidizer. Could you give us any advice as to what causes the clean gas holes?

A.—On examination of your casting we are of the opinion that your trouble is caused by the metal absorbing gas while being melted and we suggest that you overcome this difficulty by using an alloy of 50 copper and 50 nickel in making your mixture.

Melt 50 pounds of the nickel alloy and 35 pounds copper together, using a mixture of borax and charcoal on the top while the metal is melting. When the copper and nickel are melted hot, add the zinc a little at a time; stir well and add the tin and lead. As a deoxidizer, add 3 ounces manganese copper and 3 ounces magnesium copper, composed of 90 copper and 10 magnesium.

Have your sand as dry as possible in making the mold; also, secure your nickel copper alloy in the form of shot. Your trouble is due, as we state, to gas absorbed in melting, and to overcome this, use new metal. Scrap metal is very poor economy in this class of work. Also, use care in melting and melt fast; pour like yellow brass.

W. J. R., Problem 4,016.

Heat Reflecting Metals

Q.—Will you please write me just what sheet metals will stand heat and still retain their reflective qualities? The heat is no greater than will heat to a red color a piece of iron 3/16 x 1/2 inch placed 1 inch over the gas burners, as we have tried it. It does turn tin black. Having a piece of aluminum, we tried that for a week and it held bright but hardly think it will for any time longer. We want it to retain its lustre as a reflector of heat so as to concentrate it and make a stronger wave. Will the so-called stainless steel hold up, or soft steel plated with chromium or

cadmium? They claim Alleghany Metal will, but it costs too much for our purpose.

A.—Of the non-ferrous metals, copper is used as a reflector on electric heaters, and Monel metal would also answer your purpose. This metal will stand heat and will not tarnish. Alleghany Metal might answer better than any other metal, possibly.

We are sending you a small sample of Alleghany Metal for your inspection and trial. This metal will take a high polish and is strong and will stand heat and is non-corrosive. Any of the stainless steels might answer your purpose, also.

We are also sending you a small piece of Monel Metal for your inspection and trial.

W. J. R., Problem 4,017.

Lead Plating Copper Braid

Q.—We are having trouble lead plating copper wire braid. This wire braid is attached to a battery terminal and is 6 inches in length. The terminal is brass and plates easily. In fact, we have plated thousands of these terminals separately without trouble. The terminal itself when attached to the braid also plates, but the braid does not.

Our opinion is that the copper wire composing this braid, being drawn through oil, has an incrustation of oil which prevents the deposit from taking. Potash should take this off but doesn't. Acid doesn't affect it.

The following is the lead solution used:

To each gallon of water is added

Caustic soda, 76 per cent	24 oz.
Lead acetate crystallized	8 oz.
Powdered rosin	¼ oz.
Water	1 gal.

We would appreciate your advice or any information you may have on the subject.

A.—The samples submitted by you have been plated by us as follows:

(1) Immersed in a solution of caustic soda to remove any grease.

(2) Hung in an electric cleaner for 30 seconds. The cleaner is made as follows:

Caustic soda	2 oz.
Causticized ash	4 oz.
Silicate soda	1 oz.
Water	1 gal.

Steel tank for cathode; temperature 200° F.; voltage 8; work as anode.

(3) Rinse in cold water.

(4) Dip in bright dip as follows:

Sulphuric acid	1 gal.
Aqua fortis or nitric acid	½ gal.
Muriatic acid	1 oz.

(5) Rinse in cold water and strike for 30 seconds in a hot copper bath made as follows:

Copper cyanide	2½ oz.
Sodium cyanide	4½ oz.
Caustic soda	1 oz.
Water	1 gal.

(6) Rinse in cold water and transfer to a U. S. Bureau of Standards fluoborate lead plating solution made as follows:

Carbonate of lead	20 oz.
Hydrofluoric acid (50%)	32 oz.
Boric acid	14 oz.

Place hydrofluoric acid in lead-lined tank; add the boric acid, stirring until dissolved. Allow solution to cool. Mix carbonate of lead with water to form a paste and add to the solution. After as much as possible of the carbonate has been dissolved, allow the solution to settle and transfer the clear solution to a lead-lined or asphalt-lined tank. Dilute the solution to one gallon and add 0.02 ounces of glue dissolved in water.

Use cold, with sheet lead anodes; current density, 15 to 20 amperes per square foot at 2½ to 3 volts. A fine-grained deposit of any desired thickness may be obtained.

The samples, which were plated for 30 minutes, have been returned to you under separate cover for examination.

W. F., Problem 4,018.

Pickling Welded Steel

Q.—Please give me formula for making a good pickling solution for removing scale from welded steel tubes.

A.—A 10 to 20 per cent sulphuric acid solution is generally used by steel mills for removing scale from tubing. Sometimes sodium chloride is added to the acid but this attacks the base metal rapidly. It is better to use the straight acid at a temperature of 160° to 180° Fahrenheit, with some good inhibitor.

G. B. H., Problem 4,019.

Sodium Silicate Protective Coatings

Q.—I would like to know if you can give me any information about the use of silicate of soda as a protector from heat-tarnishing on gas stove work.

Our finishes are brass and nickel plated iron and sheet steel, and I have been trying out soda to take the place of lacquer, which, you know, burns off very easily. I dilute the silicate to 12 deg., dip the work in it after it is plated, then bake in 500 deg. heat. It gives a good protection from heat tarnishing for a week or so, but after this length of time it seems to pulverize into a powder and can be brushed off, leaving no protection at all. Any information you can give us, or any suggestions will be greatly appreciated.

A.—We believe that a large part of your trouble is due to two things: First, excessive heat in baking; second, too dilute a solution of silicate.

Try baking at not over 150 deg. F., and increase the density of the silicate solution up to 20 to 25 deg. Bé. The addition of from two to three ounces of boric acid per gallon of silicate will add greater heat-resisting qualities.

For a clear protective coating that has high heat resistance, try gum lac dissolved in aqua ammonia in the proportion of six ounces of gum per gallon. Heat to speed up solution of the gum. Use cold. This coating will stand up to 550 deg. F.

W. F., Problem 4,020.

Silver Plating Pewter

Q.—We would like your aid on a process to silverplate old pewter and lead hollowware. The process we have now is slow and results are uncertain, so any advice you can give us will be appreciated.

A.—It is quite a task to clean old pewter and lead work. It is hard to remove the oxidation that has formed, but it must be completely removed before plating, if the plating operation is to be successful.

The method used is to place the work in a fairly strong muriatic acid nickel (1 part acid, 1 part water) to loosen the oxidation, and then to scratchbrush or scrub with pumice until perfectly clean.

A buffing operation using tripoli on a loose buffing wheel prepares a smooth surface. The work is then washed in gasoline to remove excess of buffing material and then colored on a loose buff wheel with a lime composition. The work should be cleaned in a mild alkaline cleaner and placed in a special silver strike made of 0.10 oz. of sodium cyanide, ¼ oz. silver cyanide, 1 gallon water. It is then transferred to the regular silver strike which should contain 6 ozs. sodium cyanide, ¾ oz. silver cyanide and 1 gallon water. Finally, place work in the silver solution, which should contain approximately 3 ozs. of metallic silver and 4 ozs. of free cyanide to each gallon.

O. J. S., Problem 4,021.

White Gold Flash

Q.—What is the composition of the "white flash" used by jewelers on white gold? Will it work on silver?

A.—Some manufacturers of white gold articles flash their work in a nickel solution to prevent tarnishing; others use a tin solution. It depends upon the class of work being done, but the tin deposit is usually employed.

The following formula will give good results if used at a temperature of 110° F., with 1 to 2 volts pressure:

Stannous chloride	1 oz.
Sodium cyanide	2 oz.
Water	1 gal.

O. J. S., Problem 4,022.

Patents

A Review of Current Patents of Interest

Printed copies of patents can be obtained for 10 cents each from the Commissioner of Patents, Washington, D. C.

1,755,554-5-6-7. April 22, 1930. **Heat-Treated Nickel-Copper-Aluminum Alloy and Method of Heat Treating the Same.** William A. Mudge, Huntington, W. Va., assignor, by mesne assignments, to The International Nickel Company, Inc., New York.

In the treatment of nickel-copper-aluminum alloys containing less than 20% of aluminum and at least 15% of nickel, the steps consisting of heating the material to above 600° F. and allowing it to cool.

1,755,686. April 22, 1930. **Coated Metal and Process of Making the same.** Fredrik W. de Jahn and Joseph G. Dely, New York, N. Y., assignors to Chemical Research & Designing Corporation, New York.

A method of coating metals with a metal protective layer which consists in preparing a molten mass whose dominant constituent comprises metal belonging to Group IV in Mendelejeff's Periodic System and having a melting point lower than 400° C.

1,756,049. April 29, 1930. **Method of Utilizing Bundled Scrap Metal.** Fritz Wüst, Dusseldorf, Germany, assignor to the Firm Th. Goldschmidt A.-G., Essen, Germany.

Method of treating bundled scrap metal, which consists in heating the metal bundles by electrical eddy currents to welding temperature and thereupon welding same into a homogeneous mass.

1,756,311. April 29, 1930. **Method of Cleaning Metals.** Waldo L. Semon, Cuyahoga Falls, Ohio, assignor to The B. F. Goodrich Company, New York.

The method of cleaning metals which comprises treating metals with a solution comprising a strong non-oxidizing acid and a small proportion of an arylamino derivative of a benzothiazole.

1,756,381. April 29, 1930. **Apparatus for the Production of Molten Liquid, Coats of Enamel, Glass, and the Like by Spraying Upon Metal, Stone, or Other Surfaces or Bodies.** August Pahl, Berlin-Wilmersdorf, Germany.

Apparatus of the class described, comprising a container, a duct to discharge powder from the container, said duct having an intake end at an elevated point in the container and above the lever of the powdered material in the container, a burner tube in which the discharge end of the first named duct is arranged.

1,756,739. April 29, 1930. **Apparatus for Applying a Soft-Metal Surfacing to Hard-Metal Plates.** August Gunthard, Arcola, N. J., assignor to The Chemical Equipment Manufacturing Company, Paterson, N. J.

An apparatus for applying a soft metal coating or surfacing to hard metal plates, sheets, strips or the like comprising means for feeding the same horizontally in a given direction and means below the plate for progressively heating and cooling the same in the direction of its movement.

1,757,507. May 6, 1930. **Alloy.** Maurice E. Barker, U. S. Army, Cambridge, Mass., assignor of one-fifth to Harry H. Semmes, Washington, D. C.

An alloy containing 55% to 65% nickel, 27% to 37% copper and 3% to 13% silver.

1,757,508. May 6, 1930. **Alloy.** Maurice E. Barker, U. S. Army, Cambridge, Mass., assignor of one-fifth to Harry H. Semmes, Washington, D. C.

An alloy containing 37% to 47% nickel, 45% to 55% iron and 3% to 13% silver.

1,757,671. May 6, 1930. **Method and Means of Electroplating.** Axel O. Langseth, Mansfield, Ohio, assignor to The Ohio Brass Company, Mansfield, Ohio.

An anode for plating valve seats comprising an exposed portion of spherical shape and composed of a metal unaffected by an electrolyte, means projecting from the exposed portion to connect it to a source of current supply and a covering of in-

ulating material upon the aforementioned projecting portion.

1,757,714. May 6, 1930. **Nickel Anode.** George B. Hogaboom, Matawan, N. J., assignor to Hanson-Van Winkle-Munning Company, Matawan, N. J.

A substantially carbon-free nickel anode comprising substantially 98% to 99%+ nickel, and substantially 1% to 2% of manganese and silicon.

1,757,735. May 6, 1930. **Apparatus for Treating Material.** Kurt Theodore Potthoff, Brooklyn, N. Y., assignor to U. S. Galvanizing & Plating Equipment Corporation, a Corporation of New York.

A machine of the class described comprising a basket, means for rocking the same a predetermined period of time, means for automatically imparting additional movement to said basket and power operating means for actuating both of said means.

1,758,293. May 13, 1930. **Tarnish-Resisting Silver and Silver Plate and Process for Producing the Same.** William S. Murray, Utica, N. Y., assignor to Oneida Community Limited, Oneida, N. Y.

The process of treating silver to render it tarnish resisting which consists in subjecting the silver to the action of and impregnating it with a halogen element.

1,758,348. May 13, 1930. **Composition for Soldering Aluminum Ware.** Frederick L. Benedetti, Black Diamond, Wash.

The composition herein described for use in applying solder to aluminum ware, comprising a mixture of comminuted aluminum and brass in about the proportion of two-thirds and one-third respectively, with a small quantity of olive oil to form a mass of dough-like consistency.

1,758,531. May 13, 1930. **Vacuum Dispersion Coating Process.** Wilhelm Anton Franz Pfanhauser, Leipzig, Germany, assignor to Gesellschaft für Elektrodenzerstaubung G. m. b. H., Bohllitz-Ehrenberg, near Leipzig, Germany, a Corporation of Germany.

A process for coating articles with metals by electrodes dispersed in vacuum which consists in passing said articles in proximity to the electrodes and simultaneously directly cooling the articles.

1,758,682. May 13, 1930. **Pad for Electroplating Devices.** Peter J. F. Batenburg, Racine, and Cyril J. Atkinson, Milwaukee, Wis.; said Atkinson assignor to said Batenburg.

A pad for electro-plating devices comprising a body of yielding absorbent material, and molded masses of metal salts disposed within said body.

1,759,169. May 20, 1930. **Metal Alloy and the Process of Forming the Same.** Jens J. Olsen, San Antonio, Tex.

An alloy containing copper, iron and nickel in approximately the proportions by weight of 140 to 150 lbs. of Copper, 5 lbs. of iron and 2½ lbs of nickel.

1,759,171. May 20, 1930. **Means for Electroplating Tubes internally and Externally.** Victor L. Soderberg, Detroit, Mich., and C. Roy Gleason, Chicago, Ill.

A combined anode and holder for a tube to be electroplated, comprising a rod, a clamping head on the upper end of the rod, and a second clamping head on the rod below the other head, one of the heads being detachable, the upper head having a part of conducting material insulated from said rod and adapted to engage a tube arranged in the holder, means for suspending said rod in electrically conductive relation to a bus bar, and means for connecting said part of conducting material to a second bus bar.

1,759,279. May 20, 1930. **Material for the Low-Temperature Soldering of Metals.** Jules Alfred Rognon, Levallois, Perret, France.

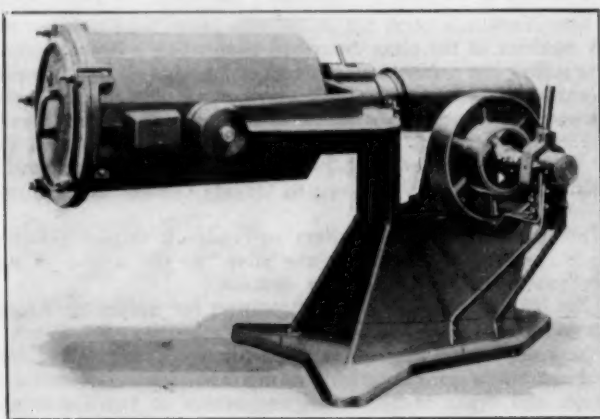
A composition for the low-temperature soldering of metals, comprising a mixture of borax, 18%; zinc chloride, 40%; sodium bromide, 34%; and aluminum bromide, 8%, the aforesaid percentages being by weight.

Equipment

New and Useful Devices, Metals, Machinery and Supplies

Spiral-Gear-Driven Burnishing Machines

The Crown Rheostat and Supply Company, 1910 Maypole Ave., Chicago, Ill., is introducing an improvement in burnishing machine design with a new method of reduction and driving—the spiral gear drive. The principle of this gear drive is the same as that which has been used successfully in "Crown" gear-driven electric lathes, it is stated. The idea is said to have numerous advantages



New Type Burnishing Machine

over other methods of drive. Starting is much easier. There is no slippage and the power application is smoother and more positive. According to tests made, the "spiral" gear drive gives maximum driving efficiency. Another factor contributing to its greater operating efficiency is that it is noiseless, the company states.

The weight of the machine illustrated is 2250 pounds, which provides ample base for running at full speed under heavy load with minimum vibration, especially when the drum is loaded with heavy work. There are two models; No. 1 has capacity of one bushel; No. 2 has capacity of three bushels.

The drive gear is made of high grade steel; driving gear is made of special phosphor bronze; this is said to be the accepted combination for longest gear wear and driving efficiency. The machines are all equipped with clutch pulleys.

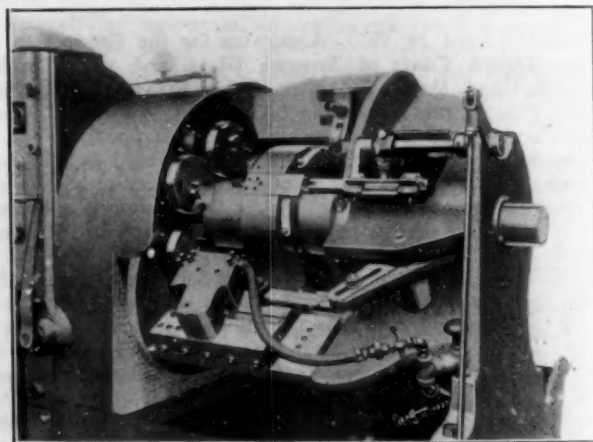
New Sealing Compound

Quigley Company, Inc., 56 West 45th Street, New York City, manufacturers of "Hytempite" and "Triple-A" protective coatings, announce the manufacture of a new plastic, expansive compound for sealing thread, flange or gasket joints. It is called "Q-SEAL." The compounding of this material was made possible by the discovery of a mineral, a phenomenon of nature, which is not only a natural lubricant and preserver of metal, but when subjected to heat expands to several times its normal volume, the company claims. This mineral is ground to a very fine mesh and used as the principal pigment in the compounding of "Q-SEAL." The principal vehicle or mixing agent used is said to be impervious to crude oils, all of their derivatives, acids, etc., and non-corrosive. The substance, according to the manufacturer, is easily applied to joints with a brush. The expansive qualities fill any imperfections in threads, flanges or gaskets. The compound seals joints leak-proof and prevents rust and corrosion. Joints fabricated with it may be broken with ease regardless of age or the conditions they have been subjected to. The compound is very economical to use, it is stated.

New Six-Spindle Horizontal Lathe

The accompanying illustration shows a new product of the Baird Machine Company, Bridgeport, Conn. This is a six-spindle horizontal 7 by 8 inch lathe on which patents have been applied for. It is a machine similar to this company's horizontal six-spindle chucking machine. It was designed to handle work best turned on centers and the center bar of the machine carries a turret containing the tail centers, this bar and turret indexing with the spindle turret. Tail center turret is adjustable longitudinally to suit length of work. An important feature is the automatic take-up for looseness or slack on centers which develops in doing work of this nature. At each station, the slides which carry the centers are unlocked, the looseness taken up and the slides again locked, all done automatically. Tail centers are withdrawn by the operator placing his foot in a natural position on a treadle, leaving both hands free to handle the work. When the machine is arranged for "double indexing," two pieces of work are unloaded and loaded and the turrets index two stations at each cycle of operations; when operator raises his foot from the treadle, one center advances before the other so that he can locate first one piece of work on its center and then the other, doing this more easily and more quickly than if he had to line up two pieces on their respective centers at the same time.

Another feature is automatic safety control and machine stop, particularly if the operator is attending more than one machine. If the operator is late in getting to the machine to unload and reload, the machine automatically stops when the cycle of operations is completed. The machine is automatically reset to proceed



Head of New Six-Spindle Lathe

with its work by the actions of the operator in the ordinary process of unloading and reloading work.

When set up for "single indexing," five work stations are available for each piece, four stations being provided with the regular longitudinal tool slides and the fifth station can be provided with some other tool arrangement, cross slide, cross drilling attachment or whatever it is practicable to apply to do the work or operation needed. In other words, the equivalent of five lathe operations (or four lathe operations and some other kind of operation) is available for each piece. When "double indexing," two pieces would be unloaded and loaded at each cycle of operations and two work stations or equivalent to two lathe operations would be available for each piece. If required, chucks or other holding fixtures can be used on the spindles in place of and, in some cases, in addition to the center.

Recirculation and Incineration in Japanning and Baking

The Use of the "Maehler-Universal" Oven Heater in Industrial Plants Performing These Operations in Metal Finishing

By A. E. MAEHLER

Secretary, The Paul Maehler Company, Chicago, Ill.

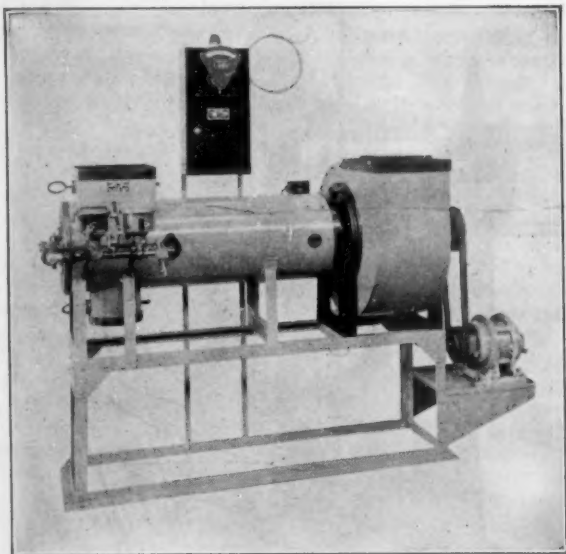
The growing popularity of baked enamel and japanned finishes, accelerated possibly by their widespread use in the automotive industry, has brought about the rapidly increasing use of industrial ovens for these and other processes requiring temperatures ranging from 250 to 700 degrees Fahrenheit. While certain noteworthy improvements in oven construction have been perfected in the past decade, the matter of providing safe, clean, efficient heat for industrial ovens has come in for careful constructive consideration only during the past three years. Most ovens installed up until a few years ago were heated by radiant type heaters installed within the oven and operated with gas, electricity or fuel oil. In a heater of

intake for gas combustion being provided, a soft, quiet visible burner flame is produced and the use of a visible pilot and automatic electric ignition is possible. An adjustable fresh air inlet at the intake end of the heater permits the introduction of fresh air into the heater at room temperature when desired.

In the operation of the heater the air from the oven with its vapor content passes through the heater flame where all explosive gases developed in the oven are incinerated. Thus the dangerous vapors are completely destroyed and in their destruction a notable economy is effected, the burning of the vapors generating approximately 150,000 B. t. u. per gallon of enamel distilled from work in process. As the entire volume of circulating medium passes through the heater many times a minute, it will be seen that it is never possible for it to contain sufficient volatile vapors to create even the slightest possibility of explosion.

The heater has shown a continuous efficiency of 95% to 99%; it operates at 33 1/3% above oven temperature. At 450 degrees F. oven temperature, for instance, the circulating air is normally returned to the heater at 400 degrees F., and it is therefore necessary to raise its temperature but 50% to maintain the oven temperature. The fuel economy is readily apparent. A highly accurate thermostatic control which can be set for any desired temperature controls the fuel flow to maintain the oven temperature at the setting. Loss in the oxygen content of the circulating medium never exceeds 2%, even after many hours of operation. Full circulation of the air to all parts of the oven is provided by the slight plus pressure generated. The floor, usually the coldest part of the oven, becomes the warmest.

An ingenious system of safety controls is provided on the heater

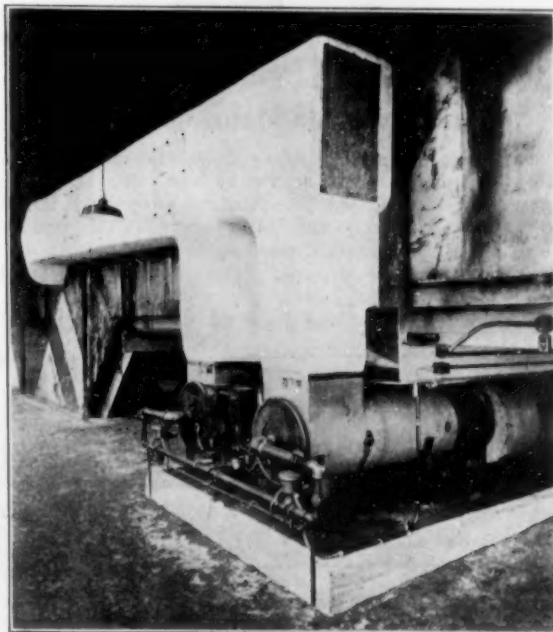


"Maehler-Universal" Oven Heater

this type it is necessary to bring the radiators to a very high temperature before effective radiation begins, causing excessive fuel consumption. Another disadvantage is failure of even the most efficient types to provide anything approaching an even temperature in all parts of the oven. A serious hazard is created in ovens of this type by the presence of explosive vapors distilled from the japan or enamel and numerous explosions and often disastrous fires have resulted. While attempts have been made to overcome the dangers of explosion by the use of ventilating fans to draw off the hazardous vapors, this measure often results in the introduction of a sufficient quantity of fresh air to create a highly combustible mixture and serves to increase the danger. Great heat losses also result.

Recirculation and incineration are the results of careful scientific study to overcome the dangers and increase the efficiency of industrial baking. Recirculation means simply withdrawing, reheating and returning the air, known in such installations as the circulating medium. To achieve the desired results, an entirely new type of industrial oven heater known as the "Maehler-Universal" has been developed.

The use of low pressure heated air places the heater outside the oven, where it is accessible at all times during operation and permits the use of much more efficient heating equipment. The circulating medium is drawn from the top of the oven by a high temperature suction fan located at the exhaust end of the heater, passes through the heater and returns through the fan to the bottom of the oven. The fan being of the suction type drawing the air through the heater, and an independent throat and air

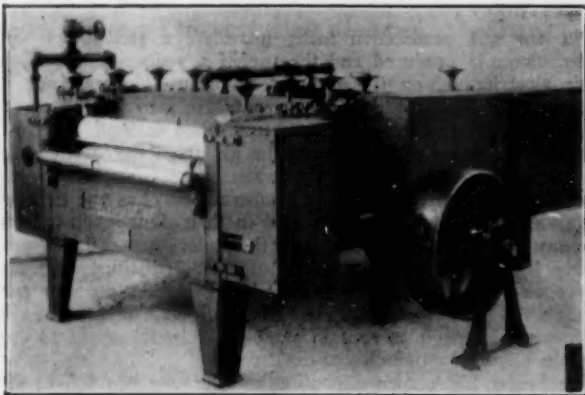


Typical Heater Installation

itself to guard against fire or explosion. The recirculation and incineration system has been in use for three years and applied to more than 250 old and new oven installations. It is the development of the industrial oven engineers of The Paul Maehler Company, Chicago, manufacturers of industrial ovens. Complete data on its operation and application will be furnished to readers on request by the company.

Continuous Sheet Cleaner and Dryer

The accompanying illustration shows a new product of The Torrington Manufacturing Company, Torrington, Conn. This machine, known as a continuous steam cleaner and dryer, is for sheet and strip metal. The metal is fed into the cleaning compartment by a pair of rubber covered feed rolls. Within the compartment is a series of water or cleaning solution sprays located both above and below the metal, together with two pairs of fibre brushes through which the sheet or strip passes.



Strip and Sheet Metal Cleaner

Conducting the metal through the steam compartment is another pair of rubber covered feed rolls which also serve to remove the bulk of the water or cleaning solution.

In the drying compartment are seven driven steam rolls arranged four above and three below the metal in staggered arrangement with an additional pair of fibre brushes located mid-way in the compartment.

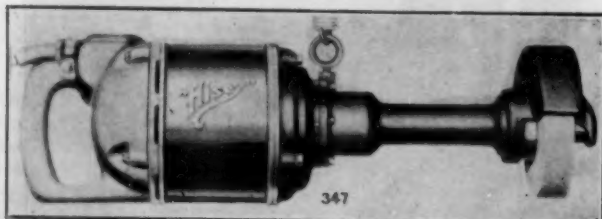
The machine is made in varying widths for metal up to 48 inches wide. Facility is provided for a winder if necessary and the construction of the machine is such that thin metal will feed through automatically.

The machine is belt driven requiring about 15 horsepower at the usual speed. All facilities for adjustment of feed rolls, brushes and steam rolls are provided.

New Portable Hand Grinders

A new series of portable, heavy duty hand grinders has been developed and placed on the market by The Hisey-Wolf Machine Company, Cincinnati, Ohio. The machines are one and two horsepower capacity, equipped with ball bearing motors and roller-bearing spindles. Motors are rated for continuous duty and mechanical parts have been designed for severe service, especially as regards the special bearings used.

These machines are available for either direct or alternating current operation.



Heavy Duty Hand Grinder

The single phase alternating current machines can be plugged into lamp socket. The makers state the machine thus operated will start and pick up speed instantly under any load within twice the rated capacity.

An advantage of 1 and 2 horsepower machines used in conjunction, it is stated, is that grinding wheels from the heavier machines may be transferred to the lighter machines when worn down sufficiently to reduce efficiency on the two horsepower outfit. The higher speed of the one horsepower compensates for the smaller diameter.

Stainless Steel and Chromium Polish

A new type of polishing composition, said to have been developed especially for the purpose of polishing stainless steels and chromium plate, has been placed on the market by the Buckeye Products Company, Cincinnati, Ohio, makers of buffing and polishing compositions of various kinds. The new product, known as "No. 80 Speedie Buffing and Polishing Composition," is stated to have been compounded after many tests and experiments in the company's laboratories. The makers claim it is based on a new idea regarding the properties of a polishing compound for stainless steels and chromium. It is stated that tests under working conditions in plants have proven the substance successful, and that its development was a natural consequence of the growth in use of stainless steel and chromium plate.

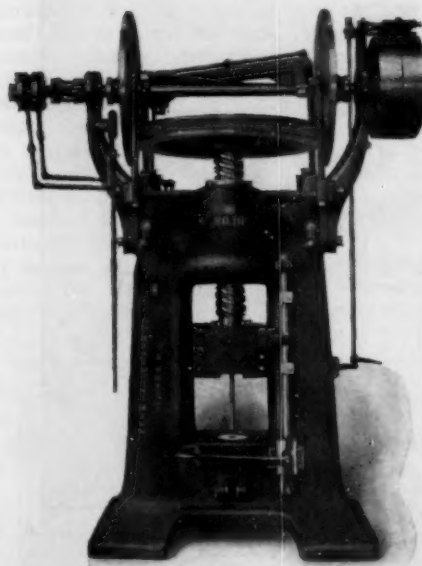
Readers desiring further information regarding the new composition may obtain it by addressing the manufacturer.

Equipment for Hot Pressing Brass

Zeh and Hahnemann Company, Newark, N. J., offer a complete line of patented percussion presses for the manufacture of hot pressed brass parts. Such parts, it is stated, are being widely used in place of articles formerly produced by casting, automatic machining, etc., and provide certain advantages which should be of

interest to makers and users of such material. The machines are made in a range of sizes and types which cover a wide variety of output such as jewelry, emblems, sheet stamping, heavy cold pressing, hot pressing of brass part requiring up to 15,000 foot pounds of pressure at each stroke, and for replacing drop hammers for forgings requiring from 30,000 to 50,000 pounds per stroke.

The company states the machines have high mechanical efficiency, being immune to variations in blank thickness.



250-Ton Press for Metal

They are equipped with brakes, ejectors, friction drive, emergency stop, massive frame construction, wear adjustments, etc. The products of the machines used for hot brass pressing are stated to have smooth surfaces, easy machineability, strict homogeneity and high strength due to compression. Parts may in many cases be polished directly after pressing, without preliminary grinding.

Readers of THE METAL INDUSTRY may obtain full information upon application to the manufacturer.

Activated Alumina

Activated alumina, a specially prepared, partially dehydrated aluminum trihydrate in the form of hard porous masses, has been developed recently by the Aluminum Research Laboratories of the Aluminum Company of America, Pittsburgh, Pa. Prior to the development of this new form, alumina was obtainable commercially only as a powder manufactured by the Bayer process, or as a slag produced by electrothermal processes. The absorptive properties of partially dehydrated alumina in powder form have been known for many years but because of its physical condition few if any commercial applications were possible. The preparation of the material in the form of hard masses permits of grading into sizes ranging from a powder to pieces approximating 1½ inches in diameter. Its stability, high purity, inertness to chemical action, large surface area or porosity per unit volume, together

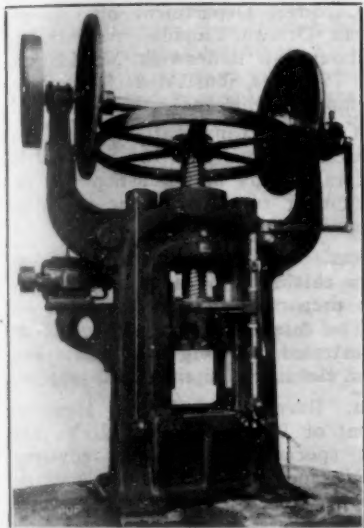
with the affinity of alumina for vapors and gases, combine to form the basis of commercial merit for the product, it is stated.

It is believed that this new form of alumina is destined to assume a prominent place among the various commercial absorbents and will find wide application in industries engaged in processes involving absorption of various impurities, vapors and gases, as well as certain catalytic processes.

Friction Spindle Presses for Metals

A line of friction spindle presses for hot pressing of ferrous and non-ferrous metals, coining, stamping, cold swaging, etc., is offered by The Schatz Manufacturing Company, Poughkeepsie, N. Y. The company states the outstanding advantage of their machines is guaranteed unbreakability of frame, spindle and fly-wheel. Other features are stated to be high speed, quiet operation and its usefulness for work ordinarily done by crankpress, hydraulic press or drop-hammer, and for various kinds of bending and forging operations.

The machine, one type of which is shown in the accompanying illustration, operates by means of two large revolving discs at the top. When the operator depresses the horizontal lever below, the ram is set in motion, the speed of its descent accelerating steadily, and a heavy impact resulting. The impact, besides performing the work of the machine, reverses the ram's direction automatically and it rises to the neutral position, where it is held by a safety locking device which must be released before each impact. The ram can also be operated continuously where such operation is needed.

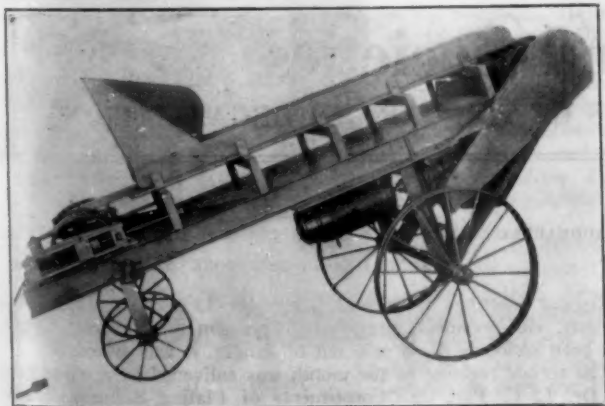


Friction Spindle Press

The machines are manufactured in sizes ranging from 25 to 1,400 tons pressure, and in a number of designs to fit users' needs. Full information may be had upon application to the manufacturers.

New Portable Magnetic Separator

The Beardsley and Piper Company, Chicago, Ill., announce a new portable magnetic separator unit. The new unit is stated to provide positive separation of scrap, shot and tramp iron from sand and other materials at any spot about the plant. This unit has already won much praise from users because of the thoroughness with which it operates and because it removes only the metal parts and does not pick up or waste any of the material being conveyed, the makers claim.



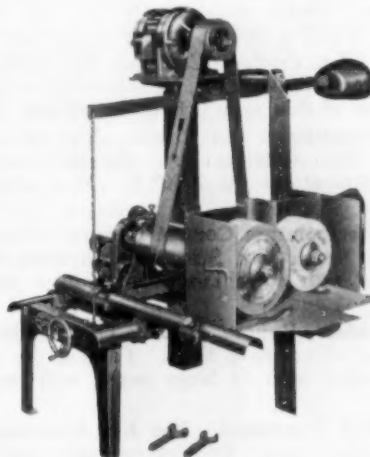
Portable Magnetic Separator

It may be placed under discharge chutes or bins at the discharge or in front of the receiving end of the belt or flight conveyors or may be adapted to any machine or process where complete magnetic separation is necessary.

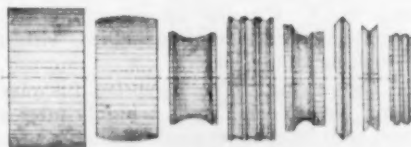
The new unit consists of a short belt running between two pulleys, the magnetic pulley being at the head or drive end. Metal parts or shot are picked up by the magnetic pulley and are carried over into a suitable discharge chute. The drive is new in application, consisting of a motor generator set, the motor of which drives the belt through a speed reducer and chain while the generator furnishes DC current at correct voltage for the magnetic separator. This gives a unit that requires only one connection to the power supply—it may be either DC or AC, as desired. The entire unit is mounted on a sturdy steel frame supported by two large wheels at the head end and two small wheels at the foot end.

New Wheel Surface Truing Machine

A new type of automatic polishing wheel truing machine has been placed on the market by the Excelsior Tool and Machine Company, East St. Louis, Ill. This machine has a number of advantages, according to the makers, including saving of time and labor, and improvement of wheel efficiency. The machine will true felt, leather, fabric or buff wheels to any shape by means of straight or master-shaped abrasive cutting wheels. There is no



Wheel Truing Machine



Various Wheel Shapes

tendency to burn or injure the wheels, it is stated, and after true surface is obtained, very little dressing is required. One minute is the usual time for truing a wheel, only enough of the surface being removed to obtain the smooth, true surface necessary for recoating. The standard size machine will take wheels up to 16 in. diameter and up to 6 in. face. It is 7 ft. high and requires floor area 6 by 6 feet. It weighs 2,300 pounds, has 7½ horsepower, A. C., 60 cycle, 3 phase motor. An abrasive grinding wheel is supplied with it, and special shapes of master wheels may be had on order.

A feature of the machine is dust hood of rigid sheet metal construction with hinged doors and top of unbreakable glass permitting operator to view the truing process at all times. The polishing wheel is oscillated as it is trued in order to provide better surfacing action and preserve the grinder. For irregular surfaces the oscillation may be disengaged. All bearings are protected from dust and the machine may be placed in gluing room or any other convenient place where it can be connected to dust exhaust system.

Equipment and Supply Catalogs

National Safety Council, 20 North Wacker Drive, Chicago, Ill. Complete program of meetings, functions, etc.

Falk Parallel Shaft Speed Reducers. The Falk Corporation, Milwaukee, Wis. Bulletin 230; 68 pages; illustrated.

Safety Nuts. Safety Nut Corporation, Land Title Building, Philadelphia, Pa. Leaflet on a new type of non-loosening nuts.

Bristol's Air Operated Controller Equipment. The Bristol Company, Waterbury, Conn. Catalog 4000; large, illustrated, 20 pages.

Alcoa Aluminum Die Castings. Aluminum Company of America, Pittsburgh, Pa. Handsome illustrated booklet on die castings.

Hand and Power Bending Machines. Wallace Supplies Manufacturing Company, 1310 Diversey Parkway, Chicago, Ill. Bulletin 26, illustrated.

General Electric Company, Schenectady, N. Y., new publications: Electric Equipment for Cranes; Quartz-Rod Thermostat for Metal Melting Pots.

American Air Filters. American Air Filter Company, Inc., 215 Central Avenue, Louisville, Ky. Illustrated bulletin on filters for air compressors, Diesel and gas engines.

Tantalum Enters the Industrial Field. J. Bishop and Company Platinum Works, Malvern, Pa. A very fine pamphlet on this metal which is finding new uses in industry.

Bentonite. Silica Products Company, 700 Baltimore Avenue, Kansas City, Mo. Bulletin 107, on properties, sources, geology and production of this natural hydrous silicate of alumina.

Brown Pyrometers. The Brown Instrument Company, Philadelphia, Pa. Catalog 15A, showing instruments for measuring temperatures to 3000° F. Well illustrated; 100 pages.

Automatic Temperature Control Gauges. Harold E. Trent Company, 439 North 12th Street, Philadelphia, Pa. Bulletin TB-18; gauges with extra long scales, quick reading up to 1000° F.

Electric Grinders, Buffers, Drills. The Standard Electrical Tool Company, Cincinnati, Ohio. Catalog 36, showing the complete Standard line; 64 large pages, well printed and illustrated.

Lea Greaseless Compound. The Lea Manufacturing Company, Waterbury, Conn. Booklet on compound for cutting down and polishing stainless steel and other metals by the "dry" method.

Imhoff Consulting Service. The Wallace G. Imhoff Company, Vineland, N. J. Circular on consulting service on all forms of galvanizing and operations allied with galvanizing such as zinc melting and recovery.

The Art of Lacquering. The Egyptian Lacquer Manufacturing Company, New York City. A highly interesting booklet on lacquer and lacquer enamel, giving a great deal of good information in an engrossing manner.

Annite Cleaner. Quigley Company, Inc., 56 West 45th Street, New York. Booklet on an all-purpose detergent for industrial use, which is said to clean without chemical action by emulsifying oils and grease and liberating the dirt.

The Era of Automatic Control. The Brown Instrument Company, Philadelphia, Pa. Handsome, illustrated 32-page booklet on automatic control of many kinds of work, including die casting, enameling, heating, melting, baking, plating, etc.

Industrial Ovens. Gehnrich Oven Company, Long Island City, N. Y. A complete illustrated catalog of industrial ovens and their applications, including oven heat utilization and ventilation, loading and conveying, etc. Fully illustrated and well printed.

Merchants' Association of New York Year Book—1930. The Merchants' Association of New York, Woolworth Building, New York City. A valuable trade directory of 368 pages. Distributed to membership, consular offices of United States, and leading commercial organizations.

Maritime Provinces of Canada. Department of Interior, National Development Bureau, Ottawa, Canada. An interesting booklet of information about New Brunswick, Nova Scotia and Prince Edward Island. 79 pages, illustrated; free on request to the National Development Bureau.

Standard Electrical Tool Company, Cincinnati, Ohio. Catalog No. 36, 8½ x 11 inches, 64 pages, showing a complete line of electric drills, grinders, buffers and polishers for industrial use. Includes a number of new machines. Also, **Price List No. 36**, supplementing the catalog.

Weaver Pick-Aide Products. The Weaver Brothers Company, Adrian, Mich. A new catalog of Weaver products for pickling of metal has been prepared and will be sent upon request to the company. The catalog is very well made up in loose-leaf form, fully illustrated, showing a complete line of the company's pickling and cleaning equipment and supplies.

Accident Prevention Data. Bureau of Industrial Hygiene, New York State Department of Labor, Albany, N. Y., has just issued two important special bulletins, one covering "Accidents in Metal Stamping and Forming Plants; Analysis of 300 Cases, with Suggestions as to Prevention" by Herbert L. Reid; and "Hand Tool Accidents; Their Cause and Prevention" by Robert B. Northrup. Executives of plants will reap ample rewards by perusal of both of these excellent booklets.

Silver Alloys. Handy and Harman, 57 William Street, New York City. Bulletin 4, on use of silver for equipment to withstand chemical attack. The company states silver prices are now so low that the metal is now available for certain kinds of corrosion-proof equipment, such as that used for organic acids and salts, phosphoric acid, dilute sulphuric or hydrochloric acids, solutions of caustic alkalis, etc. The company stresses the large reclaim value of worn or broken silver equipment, due to the ready market for the metal.

Associations and Societies

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

American Electroplaters' Society

Philadelphia Branch

HEADQUARTERS, CARE OF PHILIP UHL, 243 NORTH 29th STREET, PHILADELPHIA, PA.

Banquet Preparations

The Philadelphia Branch, American Electroplaters Society, will hold its annual banquet on Saturday, November 22, 1930, at MacAllister's, on Spring Garden Street, Philadelphia. Harry Snyder will head the banquet committee and the event, as usual, is expected to be excellently arranged and attended.

New York Branch

HEADQUARTERS, CARE OF J. E. STERLING, 2501 46th STREET, ASTORIA, LONG ISLAND, NEW YORK

Regular meetings were held September 12 and 26, with Ralph Liguori, vice-president, presiding. President F. Haushalter, who has been seriously ill, is now out of danger, it was stated.

The second meeting of the month was enlivened by a paper read by Dr. L. C. Pan, on "Constituents of Plating Solutions," containing much valuable information.

ARTHUR GRINHAM, *Recording Secretary*.

Aluminum Research Institute

HEADQUARTERS, 308 WEST WASHINGTON STREET, CHICAGO, ILL.

Aluminum Analysis Standardization

The following announcement is issued by the Aluminum Research Institute:

The Aluminum Research Institute has begun an aggressive cooperative effort to standardize the methods of analyzing aluminum alloys. In the past, consumers of aluminum ingot have often been confused by receiving the results of analyses which did not closely check with the analyses reported by the smelters. Upon investigation, it was usually found that the methods of analysis used by the commercial laboratory and the smelter varied in important particulars, thus causing needless expense and delay.

Recently, the members of the Aluminum Research Institute undertook a check against each other on analyses of identical samples. A comparison of results indicated unnecessarily wide variation in findings. As a result, it was unanimously voted to enlist the cooperation of one of the leading commercial laboratories with the view to developing standard methods of analyzing secondary aluminum and its alloys.

On June 30th, the chief chemists of the concerns who are members of the Institute met with the chief chemist of an internationally known commercial laboratory. Definite plans and procedure were scheduled for the accomplishment of the end in view. The standard practices that are currently used by the commercial laboratory and by members of the Institute have been exchanged and are now being critically studied.

Standard samples of aluminum ingot, carefully prepared in accordance with specifications, have been made up and distributed to all involved. A portion of each sample is being used for analysis by each party, using his own approved method. The sample is of sufficient volume so that a portion of it may later be used by all interested laboratories in making determinations when the standard procedure has been agreed upon.

It is understood that when standard methods of analyses have been agreed upon and adopted by the membership of the Institute, they will be printed and made available for distribution by the Institute to any commercial or plant laboratory which desires to

obtain copies. In the future, it is hoped that when sales of aluminum ingot are made, it will be specified that the proposed standard methods of analysis will govern in cases of dispute. Also, that samples may be sent by mutual consent to commercial laboratories in various sections of the country which will be recognized as competent referees to undertake this kind of work. It is anticipated that such official laboratories will be used to a much greater extent than at present by both smelters and consumers of aluminum alloys to check internal problems that are not the subject of any controversy.

After an agreement has been reached within the Aluminum Research Institute upon standard methods of analysis, various interested technical organizations will be invited to consider the procedure with view to its approval and adoption.

Waste Material Dealers Association

HEADQUARTERS, TIMES BUILDING, NEW YORK

Economical operation of industrial plants through the reclamation of waste materials and the efficient and prompt disposal of surplus and obsolete equipment was the central subject of the discussions of the Salvage and Reclamation Division of the National Association of Waste Material Dealers, Inc., held at the Clifton Hotel, Niagara Falls, Canada, on September 22 and 23.

Many of America's largest industrial and public utility corporations were represented at the conference. Papers were presented as follows:

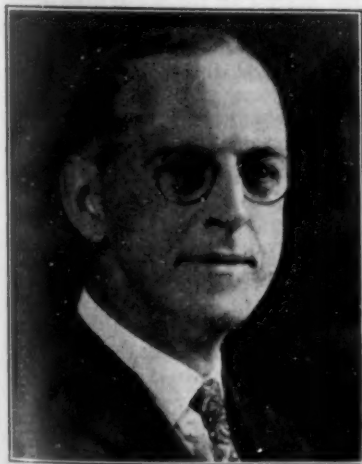
"Training Men To Prevent Waste," by F. W. Huber, American Rolling Mill Company; "Salvage Operations in the Glass Industry," by E. L. Gaines, Owens-Illinois Glass Company; "Salvage and Reclamation Divisions in Industrial Plants as an Aid to Safety and Fire Protection By Removing Hazards," by George H. Miller, E. I. du Pont de Nemours.

Remington Rand, Inc., with plants in Buffalo and Tonawanda, acted as hosts of the conference and tendered a dinner on Monday evening, September 22, at the Clifton Hotel. The same company entertained delegates on Tuesday at luncheon, after which they inspected salvage and reclamation operations as carried on at the Remington Rand plant in Tonawanda.

Personals

Howard H. Bristol

Howard H. Bristol has been elected president of The Bristol Company, Waterbury, Conn., manufacturers of recording instruments. Mr. Bristol succeeds his uncle, the



HOWARD H. BRISTOL

late William Henry Bristol, founder of the company, whose death we recently reported. The new president was previously vice-president and general manager of the company. He is the son of Franklin B. Bristol, one of the company's co-founders, and a descendant of Henry Bristol, one of the first of the Connecticut Bristols and an early settler of the New Haven Colony. Henry Bristol died in 1695.

Howard H. Bristol was born at Naugatuck, Conn., January 23, 1888. His early schooling was obtained at the Waterbury and Naugatuck grammar schools. He graduated from the Hitch-kiss School, Lakeville,

nology, Hoboken, New Jersey, in 1910, with the degree of Mechanical Engineer.

Upon graduation he entered the employ of The Bristol Company, devoting his time to research and development. In 1912, he organized an engineering department and was appointed chief engineer, occupying this position until 1920, when he was elected vice-president and assistant treasurer, a director, and general manager of the company. These offices he held until this year, when he was elected to the office of president to fill the vacancy caused by the death of his uncle, William H. Bristol. In addition to this office, Mr. Bristol is a director in the following corporations: The Naugatuck National Bank, The Naugatuck Water Company, The Naugatuck Building and Loan Association, all of Naugatuck, and The Miller and Peck Company, Waterbury. He is a member of the American Society of Mechanical Engineers.

During the years 1920-1924 he served as Burgess on the Board of Wardens and Burgesses of the town of Naugatuck, and at present he is a member of the Board of Education of that town.

William H. Bassett—Correction

In this section of the September issue, we erroneously stated that William Hastings Bassett had been elected president of the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers. Mr. Bassett was elected president of the American Institute of Mining and Metallurgical Engineers. Some years ago he was chairman of the Institute of Metals Division.—Ed.

E. O. McFadon of the Ferro Enamel Corporation, Cleveland, Ohio, has returned to St. Louis, Missouri, where he will take charge of the sales for the company in that territory.

Daniel Sather was recently presented with a new watch to commemorate the completion of his twenty-fifth year with the Watson-Stillman Company, New York.

Wilson Owen of Berea, Ohio, a graduate of Dennison University, has joined the staff of the Ferro Enamel Corporation, Cleveland, Ohio, to take charge of the jobbing sales.

E. V. Peters has become associated with the St. Joseph Lead Company as sales manager of the zinc oxide department, at the New York office, 250 Park Avenue, New York City.

W. R. Webster, vice-president of the Bridgeport Brass Company, Bridgeport, Conn., has been elected one of the representatives of The American Society of Mechanical Engineers to the American Engineering Council.

C. C. Fuller has been appointed manager of the New York office of The Foxboro Company, Foxboro, Mass., instrument manufacturers. Mr. Fuller replaces the late **W. W. Patrick** and will have complete charge. He will be assisted by **K. L. Barton**, **R. A. Rockwell** and **F. J. Leerburger**.

Frederick H. Low, plant engineer, has joined the King Refractories Company, Buffalo, N. Y., as secretary and general manager. Mr. Low is the son of **F. R. Low**, editor of "Power." He has been active in the affairs of the American Society of Mechanical Engineers, serving as chairman of the Detroit Section.

Ray P. Tarbell, formerly district sales manager at Cleveland, for The Lincoln Electric Company, Cleveland, Ohio, is now a member of the firm of Robert E. Kinkead, Inc., consulting welding engineers. He is vice-president and secretary of the firm and will take an active part in the firm's welding engineering activities. He was with the Lincoln company from 1918 to this year, joining them after attendance at Dartmouth College.

John D. Ryan, president of the Anaconda Copper Mining Company and a director of the American Brass Company, Waterbury, Conn., was recently named by former ambassador James W. Gerard as one of the sixty-four men who "rule" the United States. Another man long interested in the non-ferrous metal industry—chiefly aluminum production and fabrication—who was named in the list is **Andrew W. Mellon**, Secretary of the Treasury, whose family controls the Aluminum Company of America, Pittsburgh, Pa.

Charles L. Lawrance has organized the Lawrance Engineering and Research Corporation, 227 East 45th Street, New York. Mr. Lawrance will be the president and dominating figure in the new enterprise, through the medium of which he proposes to build up an organization to engage in development and experimental work in the aviation field and also to act as consulting engineers of various aviation interests. The new company is entirely independent of other aviation interests, and although it has no connection with Curtiss-Wright Corporation, Mr. Lawrance is continuing as director and also as vice-president of Curtiss-Wright Corporation.

Obituaries

Frank L. Driver, Sr.

Frank L. Driver, Sr., chairman of the board of directors and one of the founders of the Driver-Harris Company, Harrison, N. J., died on August 26, 1930, in Belgium, where he had been residing for five years due to ill health. Mr. Driver was in his sixtieth year.

The alloy industry loses one of its oldest representatives through the death of Mr. Driver, who founded the Driver-Harris Company in 1899 and was associated with it until his death. He was always keenly alive to improvement and expansion and it was largely due to his foresight and pioneering that the industry has grown to its present proportion.



FRANK L. DRIVER, SR.

Mr. Driver was interested in politics in Newark, N. J., where he resided many years, and the charm of his personality won him many friends. He was at one time a member of the Board of Freeholders and the Shade Tree Commission of Newark.

Mr. Driver was born in Brooklyn on July 4th, 1870.

He was the president of

the company he founded until 1925 when he retired to the chairmanship of the board of directors.

Carl Ricard

Carl Ricard, member of the firm of Ricard and Freiwald, London, England, tin merchants and operators, died in London on September 8, 1930, in his sixty-eighth year. Mr. Ricard was a world figure in the tin market, of which he was popularly known as "The King" for about twenty-five years. He was known in every quarter of the globe where tin is produced or marketed to any extent.

Colonel Robert M. Thompson

Colonel Robert Means Thompson, former chairman of the board of directors of the International Nickel Company, New York, and former president of the New York Metal Exchange, died at Fort Ticonderoga, N. Y., September 5, 1930. He was eighty-one years old and had been in failing health for several years.

Colonel Thompson was a lawyer in Boston, Mass., until 1879, when he assumed management of the Orford Copper Company which had mines in Canada. He introduced improvements in copper and nickel metallurgy. He was one of the organizers of the International Nickel Company.

Daniel Guggenheim

Daniel Guggenheim, internationally known financier and philanthropist, long connected with some of the largest mining and metal companies in the world, died suddenly of heart disease on September 28, 1930. He was 74 years old.

Mr. Guggenheim had a large interest in the non-ferrous metal fabricating industries through his extensive holdings in companies which either control or have large shares in such concerns as Revere Copper and Brass, Inc., General Cable Corporation and others. Among the mining and smelting companies in which he was interested are the American Smelting and Refining Company, the Cerro de Pasco Copper Company, and others.

Fred Dias

Fred Dias, formerly identified with the Advance Bronze and Aluminum Foundry, Los Angeles, Calif., died recently at Oakland, Calif. Mr. Dias was at one time connected with Western Stove Company, Culver City, Calif.

William B. Merrill

William B. Merrill, owner of William B. Merrill and Company, Boston, Mass., manufacturers of metallic packing, died recently at his home at Salter's Point, South Dartmouth, Mass.

Frank Blacketer

Frank Blacketer, formerly operator of the Long Beach Brass Foundry, Long Beach, Calif., died recently at his home at Santa Ana, Calif.

News of the Industry

Industrial and Financial Events

Illinois Zinc Company

Illinois Zinc Company, general offices, 332 South Michigan Avenue, Chicago, Ill., announce that they have taken over the manufacture of extruded battery cups (dry cells) under an arrangement with the Extruded Metals Corporation, a subsidiary of E. W. Bliss Company, Brooklyn, New York. The equipment heretofore in operation at the Brooklyn plant is being moved to the Peru, Illinois, plant of the Illinois Zinc Company. During this removal, customers will be supplied from stocks of extruded cups at the Brooklyn warehouse. Extruded Metals Corporation will continue its contact with the trade by acting as sales agent for the extruded cups. Illinois Zinc Company has acquired the exclusive rights in the United States for the manufacture of extruded cups under the Towne patents and is privileged to sublicense others to manufacture these patented cups, it is stated.

The process of extruding zinc cups for use in dry cells was invented a few years ago by W. M. Towne and the machinery for large scale production was built and perfected by the E. W. Bliss Company. The manufacturing and marketing of this product has been developed by the Extruded Metals Corporation, a company organized by the E. W. Bliss Company for this purpose. Under the able guidance of Mr. Towne, the business has outgrown the facilities of Extruded Metals Corporation and to meet the needs of the increasing demand, Mr. Towne secured co-operation of the Illinois Zinc Company with its vast resources, consisting of extensive ore mines in New Mexico and the Tri-State District, large smelters, rolling mills and coal mines at Peru, Illinois.

General Cable Corporation

General Cable Corporation, 420 Lexington Avenue, New York City, announces that from October 1, 1930, all sales, manufacturing and accounting activities hitherto carried on by its various divisions independently, will be transacted only by the General Cable Corporation, through district offices throughout the United States. All products of all divisions will be available through any of these offices. Accounting is considerably simplified by the provision a single contact, the central accounting office at Rome, N. Y. Billing will be done only in the Corporation's name and at point of shipment. The following are the divisions now to operate as a single organization:

A-A Wire Company; American Insulated Wire and Cable Company; Atlantic Insulated Wire and Cable Company; Detroit Insulated Wire Company; Dudlo Manufacturing Company; Peerless Insulated Wire and Cable Company; Phillips Wire Company; Rome Electrical Company; Rome Wire Company; Safety Cable Company; Standard Underground Cable Company; Southern States Cable Company.

American Abrasive Wheel Standards

American Standards Association, 29 West 39th Street, New York City, has approved a revised edition of the American standard for use, care and protection of abrasive wheels. The revision includes a number of important points, including the provision of speeds ranging from 4,500 to 16,000 peripheral feet for grinding wheels, as compared with former provision for a range of 6,000 to 6,500 feet; and steel castings for hoods on high speed wheels. The revised code was submitted a number of joint sponsors, who had previously submitted it to a technical committee composed of representatives of the Government, Industrial Accident Boards Association, labor departments of a number of States, American Foundrymen's Association, National Metal Trades Association, Metal Polishers, Buffers and Platers of North America, and other societies.

Welding Engineering and Research

James W. Owens, formerly welding aide for the Bureau of Construction and Repair of the U. S. Navy at the Norfolk Navy Yard, has resigned as director of welding at the Newport News Shipyard to become associated with the Welding Engineering and Research Corporation, 25 West 43rd Street, New York, as its director of engineering and secretary.

Mr. Owens has done much to sponsor and apply scientific welding in the construction of merchant and naval ships. In 1928 he was awarded the \$10,000 Lincoln prize for paper on arc welding, sponsored by the American Society of Mechanical Engineers, and is author of a book entitled "Fundamentals of Welding, Gas (Arc and Thermit)." He is a past vice-president of the American Welding Society, fellow of the American Institute of Electrical Engineers and a member of the American Society of Naval Architects and Marine Engineers, and the American Society of Mechanical Engineers. From 1918 to 1925, Mr. Owens had charge of welding research and development for the Bureau of Construction and Repair of the Navy, and before resigning from the Navy Department wrote the welding specifications for scout cruisers now under construction.

The company, which Mr. Owens and several other prominent engineers organized, plans to cooperate with industry to secure a more rapid, safe and economical advance of the welding and cutting processes. The divisions of the company are engineering, research, consulting, inspection and certification. Its other officers are Professor Comfort A. Adams, president; J. H. Deppeler, vice-president; C. A. McCune, director of research and treasurer. In addition to these officers, other prominent engineers will act as consultants on a technical board.

The company plans to have a fully equipped \$100,000 research laboratory and experimental welding shop in operation by January 1st, 1931. Professor Adams is Lawrence Professor of Engineering, Harvard University. J. H. Deppeler is a former president of the American Welding Society, and is chief engineer and works manager of the Metal and Thermit Corporation. C. A. McCune is also a former president of the American Welding Society and at present is president of the International Acetylene Association. He has for several years been director of research of the American Chain Company, Bridgeport, Conn. Leon S. Moisseiff is a consulting and bridge engineer in New York. He is advisory engineer to the Port of New York Authority on the Hudson River and Kill Von Kull Bridges. A. V. deForest is a consulting engineer specializing in physical, magnetic and metallographic engineering.

General Bronze Corporation

General Bronze Corporation, New York City, has booked contracts aggregating \$800,000 for white metal and aluminum architectural work to be used on five large buildings now under construction, including the Empire State Building, New York, in which there will be a great deal of aluminum work. The company also has a contract to install metal work in the City Bank Farmers Trust Company Building, New York, where nickel will be used more extensively than ever before for architectural purposes. The company believes that white metal contracts this year will amount to about 20 per cent of its total volume of business. Last year it was only about 10 per cent, including the aluminum work.

Hanson-Van Winkle-Munning Company

Hanson-Van Winkle-Munning Company, Matawan, N. J., plating and polishing equipment manufacturers, will locate a new plant this year at Anderson, Ind. Details will be reported in a later issue when they are announced.

Bronze Church Bell Weighs 20 Tons

The largest bronze bell in America, the Bourdon for the new Riverside Church, 121st Street and Riverside Drive, New York City, was recently swung into place in its tower, 400 feet above the street. The bell weighs about twenty tons and hangs together with seventy smaller bells. It is 122½ inches in diameter at the widest point. Its composition is copper and tin, alloyed espe-



20-Ton Bronze Bell on Way to Tower

cially for the purpose. It rings in low C. On its surface are figures of Saints Matthew, Mark, Luke and John. An inscription around the edge dedicates the big bell, together with a number of others, to Laura Spelman Rockefeller, deceased wife of the multimillionaire. The bell was produced by Gillett and Johnson, Croydon, England. This firm was represented by Arthur Townsend at the ceremonies attending the installation of the great bell.

Brass Ingot Statistics

Non-Ferrous Ingot Metal Institute, Chicago, Ill., reports the average prices per pound received by its membership on commercial grades of six principal mixtures of ingot brass during the twenty-eight day period ending September 12th, as follows:

Commercial 80-10-10 (1 % impurities).....	12.071c
Commercial 78% metal	10.294c
Commercial 81% metal	10.751c
Commercial 83% metal	10.783c
Commercial 85-5-5-5	11.128c
Commercial No. 1 yellow brass ingot.....	8.521c

The combined deliveries of brass and bronze ingots and billets by the members of the Institute for the month of August 1930 amounted to a total of 5,800 tons.

On September 1st, unfilled orders for brass and bronze ingots and billets on the books of the members amounted to a total of 19,298 net tons.

Radio Show

The seventh annual Radio World's Fair was held at Madison Square Garden, New York City, September 22 to 27. Many special features, of interest chiefly to radio audiences in general, marked the week, while the exhibits consisted to a large extent of finished radio receiving sets of practically all makes and designs, as well as a large number of exhibits of materials and parts. Among the exhibitors showing products of particular interest to the nonferrous metals and finishing industries were:

Aluminum Company of America, Pittsburgh, Pa.; American Bosch Magneto Corporation, Springfield, Mass.; General Cable Corporation, New York; General Electric Company, Schenectady, N. Y.; Graybar Electric Company, New York; Hamilton-Sangamo Corporation, Springfield, Ill.; The Riverside Metal Company, Riverside, N. J.; Rome Wire Company Division of General Cable Corporation, Rome, N. Y.; Scovill Manufacturing Company, Waterbury, Conn.

Niagara Falls Smelting Plant Expands

Expansion of the plant of the Niagara Falls Smelting and Refining Company, Buffalo, N. Y., has been announced. A one-story steel addition, to cost about \$25,000, has been contracted for.

Phelps-Dodge Buys Electrical Firm

Control of National Electric Products Corporation, 233 Broadway, New York, has been acquired by the Phelps-Dodge Corporation, New York, and the electrical concern will become a subsidiary of the large copper producer. National Electric Products Corporation has a productive capacity of 200,000,000 pounds of fabricated copper products per year, as well as about 150,000 tons of steel products. The companies merged to form the electrical concern were the National Metal Holding Company, American Copper Products Corporation and British-American Tube Company. Through a subsidiary, the electrical company owns a majority of the stock of Habirshaw Cable and Wire Corporation. It operates plants at Pittsburgh and Economy, Pa., Bayway, N. J., Bridgeport, Conn., Yonkers and Nepperhan, N. Y., Fort Wayne, Ind., and Los Angeles, and has offices and warehouses in leading cities of the country.

Further expansion of National Electric Products was being planned, it was said. There will be no change in its corporate structure or management.

Louis S. Cates, president of Phelps-Dodge, will become vice chairman of National Electric Products, and officials of the latter company will become directors and members of the executive committee of Phelps-Dodge, it was said.

The merger rounds out plans of Phelps-Dodge for control of subsidiaries in every phase of the copper business from mining the ore to marketing the finished product. Recently the company acquired the Nichols Copper Company, with a capacity of 600,000,000 pounds of refined copper a year.

Metal Consumption for Die Castings

The American Bureau of Metal Statistics, New York, reports that it received reports from 53 concerns that in 1929 used 43,195 tons of non-ferrous metals in the manufacture of die castings, as follows, in tons of 2,000 pounds:

Zinc	30,305
Aluminum	9,100
Copper	1,656
Tin	570
Lead	662
Antimony	120
Nickel	124
Other	658

Polishing Composition Prices

A list of price differentials covering less than barrel lots of polishing composition has been issued by The Matchless Metal Polish Company, Chicago, Ill., and Glen Ridge, N. J. The list below was issued by Glenn Cannon, treasurer:

Barrels	List Price
Not less than 100 lb.....	List Price plus 2c per lb.
Not less than 50 lb.....	List Price plus 3c per lb.
Not less than 25 lb.....	List Price plus 5c per lb.
Less than 25 lb.....	List Price plus 10c per lb.

New Corporations

Shanklin Metal Products Company, Inc., 117 North 11th Street, Springfield, Ill., has been incorporated with \$15,000 capital stock, to manufacture acetylene miners' lamps and brass and steel specialties. **W. E. Shanklin** is president, **Al Foerder**, vice-president, **J. W. McIntire**, secretary-treasurer. The departments operated are: tool room, stamping, soldering, polishing and lacquering.

Taylor Instrument Companies of Canada, Ltd., Toronto, Can., has been incorporated with \$1,000,000 capital, to take over the business of the **Taylor Instrument Companies**, Rochester, N. Y., in Canada. Offices will remain in the Tycos Building, Toronto, with **A. H. Allen** as manager, **H. W. Payne** in charge of manufacturing, and **H. R. Smith** as secretary.

Franklin Electroplating Company has been established in Dover, N. H. The company is headed by **William H. Franklin** and his two sons, **Walter** and **George E. Franklin**, and occupies space in the Sheppard building on Locust Street, to the extent of 100 x 50 ft., with an office, buffing room, generator room and plating room. The plant is equipped to do nickel, copper, silver and chromium plating on any articles.

Business Reports of The Metal Industry Correspondents

New England States

Waterbury, Connecticut

OCTOBER 1, 1930.

Stockholders of the **Scovill Manufacturing Company** at a special meeting last month unanimously approved the plan of the directors for reducing the outstanding debt. The plan calls for the purchase, through one of the company's subsidiaries of the \$21,000,000 5½ per cent debentures issued to finance the purchase of the Schrader Company of Brooklyn, N. Y., and converting them into Scovill stock. While these debentures are convertible, the holders of them have not exercised that privilege to date because the convertible price has not been so favorable as the market price of the Scovill stock. By converting the debentures into common stock, the company will save making heavy deposits in its sinking fund for maturity and interest on the debentures. Already, \$5,174,000 of the debentures have been purchased and converted.

Some reductions in the main office and branch offices have been made in the **American Brass Co.** John A. Coe, president of the company, however, declares that many of the changes are not due to business depression but to transfers of work to provide more equitable distribution among the various factories and departments. "Business is not as bad as some people are painting it," he said. "It is not nearly so bad as in 1921. We are so far ahead of 1921 that there is no comparison. We are planning some changes in our office personnel that will mean some men may be asked to resign but it is not a wholesale cut by any means."

Curtailement in the hours of work has also been made at the **Scovill Manufacturing Company**. Officials of the company state that the cuts have been made so as to keep the greatest number of people on the payroll and to distribute the amount of work equitably. This method is being followed in all cases rather than laying off workers in groups. Most of the office workers are on a four and one-half day schedule and a great part of the factory personnel is on a seven hour day, four days a week. All offices and most departments are open the full number of hours a week, but the foremen and department heads have re-arranged the hours so that some of the men will work part of the week and the rest during the balance of the week. Much the same arrangement is being followed by the **Chase Companies, Inc.**, and the **Waterbury Clock Company**.

United States Employment Bureau survey says of Waterbury for last month: "Increased employment and production is noted in some of the local industries; however, several plants are on part time and some were closed for two weeks vacation. Most are on a restricted-production basis. The surplus labor consists chiefly of unskilled workers. There is no shortage of any class of help."

Directors of the **Scovill Manufacturing Company**, last month voted a dividend of 75 cents a share for the quarter ending September 30. The quarterly dividend for the past year has been \$1 a share.

J. D. Heffernan, traffic manager of the **Scovill Manufacturing Company**, gave reports on brass, bronze and copper shipments and expected shipments at the meeting of the **New England Shippers' Advisory Board** at Maplewood, N. H., last month. Representatives of industrial firms and of the railroads throughout New England attended.

Among patents granted to local men during the past month are the following: **Daniel R. Francis**, assignor to **Waterbury Tool Company**, driving means for wire stranding machines; **David L. Summey**, assignor to **Scovill Manufacturing Company**, resistor and support therefor; **C. E. Weber and Frederick E. Hall**, North Easton, Mass., assignor to the **Chase Company's, Inc.**, hose connector for air pumps. A trade-mark was granted the **Lea Manufacturing Company**, of this city last month for finishing compositions for buffing and polishing. **American Mills Company** also registered a trade-mark.

W. R. B.

Connecticut Notes

OCTOBER 1, 1930.

NEW BRITAIN—Practically all local factories closed for three days over the Labor Day week-end. **New Britain-Gridley Machine Company** remained closed for 10 days. Some departments of the **American Hardware Corporation** also closed for that period, but the rest and the **Stanley Works, North and Judd, Landers, Frary and Clark** and **Fafnir Bearing Company** were closed but three days.

Stanley Works has formed a new subsidiary, the **R. L. Carter Company**, with a capital of \$50,000. It will carry on the manufacture of electrical woodworking tools formerly made by the **R. L. Carter Company** of Phoenix, N. Y., which business was recently acquired by the local concern. Stanley is concentrating the business in New Britain. The officers of the new company are: President, **L. M. Knouse**; vice president, **Frederick O. Fuller**; secretary-treasurer, **L. W. Young**.

Stanley Works directors declared the regular quarterly dividend of 62½ cents a share, payable October 1, to stockholders of record September 15.

NEW HAVEN—Directors of the **New Haven Clock Company**, have cut the annual dividend rate from \$1.50 to \$1 by the declaration of 25 cents a share for the quarter, payable October 1.

Directors of **Acme Wire Company**, have declared the regular quarterly dividend of 50 cents a share payable October 1.

TORRINGTON—**Torrington Company** directors have declared the regular dividend of 75 cents a share, payable October 1 to stockholders of record September 18.

Torrington Casting Company has plans for a new factory building.

WINSTED—**Morgan Silver Plating Company** of this city, is reported to be so rushed with business that it has had to place orders with outside companies. Many foreign orders have been received.

United States Employment Bureau survey says of Winsted: "Part time prevails in most of the local industries and a surplus of labor is apparent."

BRISTOL—Members of the **Purchasing Agents' Association of Connecticut** visited the plant of the **Bristol Brass Corporation**, at their annual meeting last month. N. B. England of the research staff of the Graduate School of Business Administration, Harvard University, was the principal speaker. **C. V. Chapin** of the **Bristol Brass Corporation** was in charge of the arrangements.

BRIDGEPORT—**Bullard Company** directors at their meeting last month voted to omit the next dividend payment.

MERIDEN—**International Silver Company** has declared the regular quarterly dividend of \$1.75 a share on the preferred stock, payable October 1 to stockholders of record September 12.

STAMFORD—**Yale and Towne Manufacturing Company** directors have declared a quarterly dividend of 50 cents a share, payable October 1 to stockholders of record September 19. This is a cut from \$1 a share previously paid quarterly and places the stock on an annual basis of \$2.

TERRYVILLE—The working schedule of the press department of the **Eagle Lock Company** has been further curtailed. Employees have been notified that starting this month the department will be divided into two groups, with one group working one week and the other the next week. This makes the average working week 15 hours as the schedule calls for 30 hours, each group alternating.

HARTFORD—**Bridgeport Hardware Company**, **Colt's Patent Arms of Hartford, P. and F. Corbin Company** of New Britain, **Gilbert Clock Company** of Winsted, **International Silver Company** of Meriden, **Remington Arms Company** of New Haven, **Scovill Manufacturing Company** of Waterbury, supplied souvenirs to the national convention of insurance commissioners here last month.

W. R. B.

Providence, Rhode Island

OCTOBER 1, 1930.

Starting four years ago in a small rented room at 133 Point Street, the **S and S Die Casting Company**, now at 48-50 Burnham Avenue, Cranston, represents a remarkably satisfactory growth in a short period. The building now occupied is the property of the company, and it has adjacent land sufficient for a considerable expansion. During normal times, the company gives employment to about 100 persons, including those employed within the factory building and those who take work to their homes for the completion of certain details. The product of the plant is principally in white metal, and includes all sorts of hat and shoe ornaments, buckles and the like, bracelets, necklaces and rings. In the die casting department are made statuettes and religious medals, as well as phonograph parts. The company is controlled by **Max A. Schulze**, who is associated with his son, **Henry T. Schulze**.

Louis H. Pastore, Inc., has been incorporated to conduct a manufacturing and wholesale jewelry business in Providence, with authorized capital of 500 shares no par common stock. The incorporators are: **Louis H. Pastore**, **Albert Hawkins** and **D. A. Ionata**.

Henry D. Sharpe, president of the **Brown and Sharpe Manufacturing Company**, and one of the directors of the Chamber of Commerce of the United States, has been re-appointed chairman of the committee on foreign commerce of the national chamber. Mr. Sharpe was chairman of this important committee for the years 1925-26 and 1928-29. According to the announcement, Mr. Sharpe's committee will concern itself with the study of two major subjects during the coming year, in addition to its many other activities. The major projects are a study of the United States commercial treaty policy, and the question of export merchandising.

Howard L. Carpenter of the **Albert Walker Company**, Providence, has been appointed a member of the committee on membership for the **Jewelry Institute of America**, sponsored by the **National Wholesale Jewelry Trade Association**. Mem-

bers of the committee on trades practice conferences of the same organization include **Edgar M. Dorcherty** of the **William C. Greene Company**, this city, and **Archibald Silverman**, of **Silverman Brothers**, this city.

Wilcox, Wetherald, Inc., has been incorporated to conduct a jewelry business with an authorized capital of 100 shares no par common stock. Incorporators are **Howard D. Wilcox**, **George Wetherald** and **Harry H. Wetherald**.

Fire recently partly destroyed the **Sleeper Brass Foundry** on Cato Street, Woonsocket. The plant is owned by **William Sleeper**, who states that the several hundred dollars loss is covered by insurance. The fire is supposed to have started from a defective wire.

Paramount Plating Company has been incorporated to conduct a general plating business in Providence, authorized capital stock, of 500 shares no par common. The incorporators are: **Myer Rubin**, **Joseph Goodman** and **Max Winograd**. The company has given a chattel mortgage for \$525 to **Joseph Bernstein**, covering personal property at 9 Calender Street.

Williams and Lange, Inc., manufacturers of findings, metal novelties, etc., 110 West Exchange Street, has changed its name to the **Williams Manufacturing Company**.

Mark Weisberg of the **Modern Plating Company, Inc.**, this city, has been retained by **Drumchrom, Inc.**, of New Jersey, to design a semi-commercial plating unit for the plating of drums. Twenty-five thousand amperes will be used in this unit, and it is contemplated building a plant, using 200,000 amperes of energy, to plate 1,500 drums a day in chromium and other finishes.

Approximately 3,800 employees of the **Brown and Sharpe Manufacturing Company** returned to work after a vacation the entire month of August, when the plant reopened on Tuesday, September 2, according to **Arthur H. Bainton**, superintendent. Nearly 2,000 other employees, however, were notified by mail that their vacation had been extended two weeks, but that if conditions warranted it, they would be called in earlier. Although the plant was officially shut down during the month of August, about 1,000 employees were kept steadily working.

W. H. M.

Middle Atlantic States

Trenton, N. J.

OCTOBER 1, 1930.

With a view of caring for future needs, **John A. Roebling's Sons Company** has completed negotiations for the purchase of six acres of land adjacent to Lalor and Jersey Streets and now owned by the **Jordan L. Mott Company**. Three buildings are included in the transfer, the largest being used by the Mott company as a brass shop, while the others are unoccupied. The sale in no way affects the continuance of business by the Mott company and no immediate expansion is contemplated by the Roebling company. The Mott firm intends to transfer its brass shop to another building. The amount of money which changed hands was not made known. The sale has been pending for a number of weeks awaiting the approval of bondholders of the Mott concern. The plot adjoins the Buckthorn plant of the Roebling company. The Roebling concern will use the building for the storage of a quantity of heavy equipment to be brought to Trenton from the Hudson River bridge job. No plans have been made for the use of the remainder of the land or buildings.

Jordan L. Mott Company announces a decided improvement in business during the past month. The company is employing 600 hands and all are working five days a week. Every unit of the large plant is in operation for the first time in many months. The firm's domestic trade is booming and its export business, long depressed is improving steadily. The Mott concern's prosperity is largely dependent upon building activity because its products include plumbing fixtures, enameled iron, vitreous and porcelain ware, etc. The fact that the company's business is booming seems to indicate that the real estate market is picking up after a long period of dullness. Operating with a revamped organization, the company kept the plant from closing on several occasions during more than two years of bitter struggle. It has not only sur-

vived its own troubles but is one of the first to emerge from the current business slump. The company has announced to its employees that there will be no cuts in salary and that the full five-day week will be steadily maintained. The announcement pointed out that while several other large manufacturers of brass, enamel, pottery and plumbing fixtures have lowered the wage rate, the Mott company intends to maintain present high wages and full time pay envelopes.

C. A. L.

Newark, N. J.

OCTOBER 1, 1930.

General Equipment and Supply Company, offices 9 Clinton Street, has leased for five years the two-story factory at 33 Bruen Street, for the merchandising of nuts, bolts, screws and other hardware.

Van Guytenbeek Manufacturing Company, producers of advertising novelties, formerly of 81 Warren Street, has leased the first floor of the building at Bruen and Hamilton Streets.

Brass Manufacturing Company, Scranton, Pa., is one of the new industries that may settle at Manville, N. J., it was indicated at a meeting of the Manville Chamber of Commerce. **M. F. Omalley**, president of the company, wrote to the Chamber asking advice on the proposition and received favorable replies. Mr. Omalley said that if his company settled at Manville, work for about thirty men will be provided. The president of the company has the matter under consideration and will make a definite decision shortly.

Federal Welding Works, Inc., East Orange, N. J., has been incorporated with 2,500 shares, no par, to engage in electrical and oxy-acetylene welding. **Anthony Stasio**, of Newark, and **Max Rosenberg** and **Helen Rosenberg**, East Orange, are the incorporators.

The following Newark concerns have been incorporated:

Rotator Corporation, manufacture razor sharpeners and metal specialties; 1,000 shares, no par. **Paramount Electric and Radio Manufacturing Company**, manufacture radio parts; \$50,000 capital.

Vice-Chancellor Lewis has dismissed an application of a Newark concern for a receivership for the **Pollak Manufacturing Company**, Arlington, N. J. Leo L. Pollak, president of

the company, declares his concern is engaged in a capacity business. He said the company had owed a small bill to the Newark concern. The Pollak company is engaged principally in the output of aeroplane parts and equipment and specializes in the manufacture of fuel tanks. The company has several orders on hand for the Navy Department.

C. A. L.

Middle Western States

Detroit, Michigan

October 1, 1930.

Little change has taken place in industrial conditions in this area during the last four weeks. Non-ferrous metal manufacturers in practically all instances are operating on decidedly curtailed schedules. Some are doing almost nothing at all. In some cases those engaged in producing for the motor car industry have been somewhat more favored than those in other lines. Nevertheless, the motor plants, with a few exceptions, are not increasing production as was expected a few weeks ago. Under ordinary conditions this is the season when heavy manufacturing starts. At present there is no indication that they will be operating any more vigorously than they have for some time. The same condition is troubling every line of industry. It looks now like a very quiet fall in spite of efforts on the part of industrial leaders to change things for the better.

Plating plants are more or less quiet. No one expects much of an improvement until other lines show some improvement.

Announcement has been made by **William Lenert**, president of the **Lenert Aircraft Company**, Pentwater, Mich., of that organization's intention to move to Dowagiac, Mich. The company is experimenting with an all-metal type of plane which it expects shortly to place on the market, it is said.

For the six months ending June 30, **Bohn Aluminum Company**, Detroit, reports net profits of \$688,766, after charges and federal taxes, equivalent \$1.95 a share earned on 352,418 non-par shares.

Standard Aluminum Castings Company, Lansing, reports increased orders incident to the gradual resumption of motor car manufacturing in that city.

Detroit Aircraft Corporation, has announced the sale of the Ryan aircraft plant at Lambert Field, South St. Louis, to **Phil DeC. Ball**. Manufacturing activities of the Ryan subsidiary were recently moved to the enlarged plant in Detroit, where a complete Ryan line is being manufactured. Until the time of the sale, the plant had been used as a central service station for all planes made by the Detroit company. It is understood that Mr. Ball will become a distributor for Detroit Aircraft planes and the plant will be used in that business.

Reorganization of the **Brunner-Winkle Aircraft Corporation**, and the change of the corporate name to the **Bird Aircraft Corporation**, were recently announced. The new directorate consists of Col. Henry Breckenridge, Major Thomas G. Lanphier, Henry Messinger, William E. Winkle, Frank W. Brooks, Jr., S. R. Livingstone, Howard Bonbright, Frederick C. Ford and W. W. Mills.

Frankel Company, Inc., Detroit, was recently incorporated. It deals in scrap metals. The incorporators are **L. Ivan Frankel**, 307 Detroit Life Building, **Charles E. Brown** and **Ruth Cahn**.

A plant has been leased on Cass Avenue, Detroit, by the newly organized **Power Carburetor Corporation**, which will manufacture a carburetor developed by **John B. Drahonovsky**, president of the new organization. Production is to be started soon, according to **Harry N. Miller**, secretary and treasurer.

Wolverine Aluminum Products Company is a new addition to Detroit's growing group of household equipment industries. This enterprise, sponsored by stockholders of the **Wolverine Tube Company**, was launched a year ago and during the short period it has been in existence shows a promising sales record, it is stated. The company occupies 10,000 square feet of floor space in the Ireland-Matthews Building, 7,000 Chatfield Street.

Utensils are made of aluminum in semi-permanent molds according to a patented design. The design calls for curved walls to direct heat to the center of the food mass and is said to provide an important saving in fuel while adding to the flavor and nutritive quality of the food. During the last six months a sales organization of 30 men has been built up in Detroit and branch offices opened in Milwaukee and Toledo. The 1929 annual report shows total assets amounting to \$52,329, including fixed investment of \$29,429. It might be said here that the **Wolverine Tube Company** is a large producer of seamless copper, brass and aluminum tubing.

Thompson Products, Inc., recently received an order for 160,000 valves from Lycoming Motors and also has received several orders for valves from the Chrysler, Cadillac and Buick organizations, it is stated.

According to **F. R. Valpey**, general sales manager, all Graham standard six town and universal sedans, as well as all four-speed Graham special sixes, are now being equipped with chromium plated radiator guards.

F. J. H.

Cleveland, Ohio

OCTOBER 1, 1930.

Although Cleveland has experienced the same recession in manufacturing affecting other Great Lakes industrial centers, its plant activity seems to be showing up slightly better. Apparently it is a rift in the clouds, which furnishes increased encouragement for the late fall and winter. No one seems to believe conditions are going to revive on short notice, however. It is the general opinion, particularly in the metal industries, that the improvement will be gradual and at times spotty and halting. Manufacturers of motor car parts are getting under way again, not extensively of course, but sufficiently to make conditions look a little brighter. Many plants still are operating on very moderate schedules, while others are hardly doing anything at all.

A representative of THE METAL INDUSTRY, while in Cleveland recently, was particularly impressed by the better feeling that has developed and the expectations expressed by those who have visions of better things.

The Cleveland plant of the **Great Lakes Aircraft Corporation**, is now operating full time and the number of employees has increased 100 per cent since August 1, it is stated. **B. F. Castle**, president, has refused, however, to comment on reports that the increased plant activity has been necessitated by another large contract with the Navy Department.

F. J. H.

Wisconsin Notes

OCTOBER 1, 1930.

Eugene Tetzlaff, vice-president and a director of the **General Bronze Corporation**, has been placed in charge of the western division of the company with headquarters in Chicago. He will supervise its three plants in Chicago, Milwaukee and Minneapolis. Mr. Tetzlaff was president of the **Flour City Ornamental Iron Company**, Minneapolis, which was merged into General Bronze last year. Sales at the Milwaukee plant of the concern, which was formerly the **Wisconsin Ornamental Iron and Bronze Company**, are said to be excellent. The concern is operating about 75 per cent capacity and anticipates an increase in business for the late fall.

Articles of incorporation have been filed by the **Wisconsin**

Aluminum Foundry Company, Manitowoc. The incorporators are **Edwin Pleuss, Abe Schwartz and William Ecke.** Capital stock is \$250,000.

George Vits, president of the Aluminum Goods Manufacturing Company, Manitowoc, who has been a member of the National Association of Manufacturers for many years, has

been re-nominated vice-president of the association for Wisconsin. Mr. Vits has already served as director for two years. The election of vice-presidents and other officers will take place in New York on October 6, at the regular annual meeting of the organization, which will be in the nature of a four-day business and industrial conference proceeding.

A. P. N.

Other Countries

Birmingham, England

SEPTEMBER, 19, 1930.

Signs of improvement are difficult to trace among the metal trades of Birmingham but manufacturers are hoping that the coming winter will see a revival. There are indications that trade generally is on the mend in the Midland district, for while the unemployment figures for the whole country continue very heavy the Midland area has shown several decreases in the past month. This may be partly due to replacements after the holidays.

There has been no change in the prices of copper and brass tubes during the past month. Raw copper is at a low level and is not expected to sink lower. Non-ferrous rollers of sheets and tubes find that customers are mostly using up stocks rather than place new business, and the factories have been working off old contracts, with here and there an inquiry for a small lot. The motor trade is sending in a number of orders and these are expected to increase after the annual British Shows are held in the month of November. British automobile makers are preparing a big program for next year and its production will necessitate the buying of large tonnages of non-ferrous metals. The electrical side is improving, largely as the result of anticipation of seasonal requirements for heating and lighting. Copper tubes for water conveyance are being put into service in many of the new houses being put up in Britain today and builders and landlords are being educated up to the value of such installation. As regards export business this is almost negligible. The unrest in many of the British Colonies has severely curtailed business. Where trading is taking place with Canada Birmingham manufacturers complain of competition from America.

As regards cabinet brassfoundry there is very little improvement in trade. The high tariffs in Australia have practically killed the export trade there. Indian buying has been reduced owing to the unrest in that Colony. In Africa there is a shortage of money and New Zealand is only purchasing small quantities. Export trading generally is not up to the standard of twelve months ago and very much less than two years ago. A fair amount of building is taking place in this country, especially of the municipal type. Many of these houses, however, take the cheaper sorts of brass foundry—that type which is the subject of the fiercest competition with the Continent. German firms are sending cabinet handles into Birmingham at prices with which the local maker cannot possibly compete. In fact he could not buy the raw material at the price of the finished German article. The demand for goods in connection with the building trade is likely to slacken as the winter approaches as there is always a fewer number of dwellings completed in the winter months.

Makers of brass water fittings are very quiet. Occasionally there are spurts, especially when some good contracts are arranged but on the whole business is poor. Prices are cut severely and the standard is exceptionally low, leaving a very small margin of profit. Manufacturers complain of the difficulty of export trading. They say they are quite unable to meet German competition in India. The Indian Congress, it is stated, are endeavoring to enforce a boycott against German goods but buyers are still obtaining them indirectly.

A few firms making plumbers' brassfoundry have some important contracts to complete but even here there is very little new business coming into the market.

J. A. H.

Business Items—Verified

Perfection Stove Company, Cleveland, Ohio, recently placed a contract with the **Ferro Enamel Corporation, Cleveland,** for a gas-fired "U" type continuous porcelain enameling furnace.

Canada Wire and Cable Company, Toronto, Ont., in which **Noranda Mines, Ltd.,** recently acquired an interest which gave it virtual control, has secured a large order from **De Forest-Crosley Radio Company** for fine radio wire. It is learned that the order covers the wiring for ten thousand radio sets.

Simon J. Hurst, 170 Cleveland Avenue, Buffalo, N. Y., has organized the **Hurst Bronze Company** there and plans to establish and operate a bronze working plant.

Western Cable and Electric Company, Baldwin, Wis., will ask bids soon for erection of new plant, designed by **Arthur Lee, Hudson, Wis.,** to cost \$40,000.

Northern Blower Company, Cleveland, Ohio, is expecting a busy season, according to **M. A. Eiben,** who states that current conditions have caused industrial executives to study more than ever all means of increasing efficiency, which stimulates interest in dust elimination, for which the company makes equipment. The company now has under construction such equipment for **Griswold Manufacturing Company, Erie, Pa.; New Jersey Pulverizing Company, Bayonne, N. J.; Pennsylvania Pulverizing Company, Tom's River, N. J.; J. H. France Refractories Company, Snowshoe, Pa.**

Samson-United Corporation, Rochester, New York, manufacturer of stainless steel kitchen tools and cutlery, and electrical appliances, announces the opening of a New York office in the Fifth Avenue Building, 200 Fifth Avenue, as an additional facility for Samson-United customers. **A. A. Ber-**

man has been appointed manager of this office, with **D. Koblenzer** as assistant manager.

Driver-Harris Company, Harrison, N. J., has been granted a license for melting by the **Krupp-Nirosta Company, Watervliet, N. Y.** The license covers production of Nirosta steel castings, rod, sheet, strip and wire.

Superior Pattern Works, Anderson, Ind., now occupies a building at Midland Railroad and Jackson Street, having removed from its former location at 14th and Main Streets. Production space is doubled and an electric aluminum-melting furnace will be installed. The company produces pattern and plate castings in aluminum, brass and bronze and has casting, molding and polishing departments.

St. John X-Ray Service Corporation, Long Island City, N. Y., has removed its laboratory to the Eveready Building, 30-20 Thomson Avenue. **H. R. Isenburger,** secretary-treasurer, states the company is now prepared to handle anything which can be x-ray inspected weighing up to five tons. The company has just arranged to sell products of Westinghouse X-Ray Company, Inc.

Johnson Gas Appliance Company, Cedar Rapids, Iowa, has formed connection with **Eastern Service Company, 250 Stuart Street, Boston, Mass.,** for representation in the east of its direct jet gas appliance. **R. M. Henshaw,** formerly eastern representative for the Johnson company, has joined the Eastern Service Company to take charge of the gas appliance sales.

Lincoln Metal Products Company, Lincoln, Neb., recently organized, will operate a plant for production of solder, babbitt metals and kindred products. Investment of over \$50,000 in works has been made, it is stated, and production will begin soon.

Review of the Wrought Metal Business

By J. J. WHITEHEAD

President of the Whitehead Metal Products Co. of New York, Inc.

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

OCTOBER 1, 1930.

The seasonal improvement that was expected during September did not materialize fully. However, toward the end of the month the pick up was a little more noticeable than earlier in the month, and it seems at this time as if a good deal more activity is to be looked for toward the middle of October and from then on.

The price of copper went to ten cents and sales by custom smelters were made even below this figure. Certainly these continual reductions in the price do not help to build up confidence but rather tend to make everyone hesitant about purchasing even their normal requirements.

It is believed that the worst is behind us. We have had the stock market panic, the recession in prices, and agricultural distress, and these are the steps the recession was expected to follow. There is one other item that should not be overlooked, and that is that certain failures of brokerage houses and similar speculative units were to be expected. It is believed that by about the 15th of October the situation will have materially changed for the better. Certainly the price of commodities cannot be very far from the bottom.

As to the immediate future of copper and brass and products made from these metals, one would be safe in assuming that they will follow along with general business. Probably further minor concessions in price will be made, but certainly the present prices

are very close to the cost of production. In the case of copper, $9\frac{1}{2}$, $9\frac{3}{4}$ or 10 cents represent prices for copper that permit only the larger units to make slight profits. Probably large manufacturing concerns are fully aware of this and are purchasing copper and other commodities for future delivery, probably running well into next year.

Along with the recession in building and other industrial activity, the demand for nickel has fallen off. However, the tonnage of this material to be used in 1931 will be larger than ever before because the stainless steels and products made from them will be in demand in tonnages well over those used in 1929.

Monel metal has also felt the effects of depression, but neither Monel nor nickel have been as hard hit as copper and its products.

The demand for aluminum has quieted down and is marking time along with the demand for all other metal products.

It would seem that from now on, with the general upbuilding of confidence, there will be a firming in demand for all metal products. Really what everyone needs now more than anything else is to get rid of their pessimism and look at the future with more confidence. "Never sell the United States short" was a statement made by one of our great industrial leaders several years ago. Certainly now that we are at or near the bottom no one should "sell the United States short." On the contrary, it is believed that right now is the time "to buy the United States."

Metal Market Review

By R. J. HOUSTON

D. Houston and Company, Metal Brokers, New York

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

COPPER

OCTOBER 1, 1930.

Demand for copper during September was on a fairly good scale, but offerings were in excess of sales which sent the price tendency downward from the 11 cent level to $10\frac{1}{4}$ cents per pound delivered to Connecticut Valley points. The export price has been reduced to 10.80 cents c. i. f. European ports and foreign interest on that basis was renewed on a moderate scale.

Since the first half of April prices have declined $7\frac{3}{4}$ cents a pound. Widespread general business depression and a heavy increase in over supplies were the principal factors in the market decline. The conspicuous falling off in shipments to consumers at home and abroad also reflected a sub-normal consumption at all centers of activity. It is perfectly evident, however, that the extremely low sales price of copper has discounted whatever adverse trade conditions exist.

The drop in American business and a large increase in surplus stocks in the last five months naturally has sent the trend of values again downward. New low levels for many years were established under a continuation of more or less aggressive selling. At the same time there is a growing conviction that accumulated supplies must give evidence of being absorbed before the foundation is laid for a normal copper market. The elimination of the six-day schedule at producing sources would solve the problem of overproduction in due time. Calumet and Hecla is now operating five days a week. Other big units are curtailing but not enough to remedy the harmful effect of huge stocks that cannot be liquidated on the basis of present outlet. Enormous stocks piled up above ground are always a menace to sound market conditions. Economy in production is the cure for the present subnormal situation in copper. The radical drop in price of copper to $10\frac{1}{4}$ cents a pound is nothing short of a calamity. The metal will not continue at this outrageously low level indefinitely nor at well above that figure, however, as it is extreme folly for any legitimate industry to operate on an unprofitable scale.

ZINC

Substantial sales of Prime Western slab zinc were made at $4\frac{1}{4}$ cents East St. Louis basis. Transactions included prompt and nearby shipment and were distributed among galvanizers and other consumers. Recent improvement in trade requirements was noted, but they were not important enough to bring about even a minor market rally. Conditions in the zinc industry reveal a formidable over-supply in primary hands. Stocks in August showed an increase of 5,254 tons, the tonnage carried by producers on September 1st being 122,635 tons. This compares with 75,430 tons on January 1st, or an increase during the first eight months of this year of 47,205 tons. A year ago total surplus stocks amounted to only 49,064 tons. It is significant that during the past twelve months the price of Prime Western zinc has gone from $6\frac{3}{4}$ to $4\frac{1}{4}$ ¢ East St. Louis, a drop of $2\frac{1}{2}$ cents a pound. Burdensome supplies are obviously the powerful factor in market depression. Dullness and lower London quotations were features at this writing.

TIN

Alternate movements within a narrow range were recent features in the tin market. Demand was moderate at certain periods, but conditions lately reflected some increase in buying and a strengthening of prices. In the last half of September prompt Straits tin was quoted down to 29.25¢ against sales at 30¢ on September 11th. The extreme low price of the year was 29.15¢, the lowest price since 1922 when the low point was 28.75¢. Statistics revealed an increase of 1,855 tons in visible supplies during August, thus bringing the total stocks to 43,805 tons on September 1st. These figures compare with 26,400 tons on September 1, 1929, an increase of 17,405 tons. American tin deliveries during the first eight months of 1930 amounted to 49,630 tons as compared with 62,140 tons for the corresponding period in 1929, a decrease of 12,510 tons. The bulk of the increase in world supplies has occurred since the beginning of this year. This heavy increase in stocks is due largely to the falling off in domestic de-

mand owing in great degree to the sharp reduction of requirements in the automobile industry. Curtailment of tin output in the Far East is beginning to show up to an appreciable extent. The close showed a decline to 29.15c for prompt Straits tin, the low price of the year previously touched on July 10th.

LEAD

Consuming demand for lead was in fair volume during September, with substantial increase in purchases especially in last half of month. Price movements were particularly steady at 5.35c St. Louis and 5.50c New York basis. Buying interest was displayed by nearly all consuming industries, cable manufacturers and corrodors taking the largest tonnage. Requirements were for September and October, and contracts for those deliveries make up a heavy total. Though August statistics showed an increase of 9,952 tons in stocks of lead the principal sellers were able to maintain prices. Refinery stocks, however, are more than 30,000 tons larger than on May 1st, the exact figures being 72,832 tons on September 1st and 42,015 tons on May 1st.

ALUMINUM

The aluminum market is still conspicuously steady. Depression in other fields of industry has not affected prices for primary metal. A good tonnage is moving into consumption notwithstanding the lessened demand from the automobile trade. Canadian exports of aluminum decreased sharply lately, the figures for the first eight months of this year being 29,651,500 pounds as against 42,160,500 pounds for the first eight months last year, a decrease of 12,509,000 pounds. Reports from abroad show that plans are going forward in Russia for the establishment of aluminum works in that country having a capacity of 6,000 tons annually. The Italian production of aluminum is also on a growing scale.

ANTIMONY

Business in antimony was on a fair scale at times, but the movement was not maintained at a steady rate. For a short time the price level of 8 cents, duty paid, prevailed. The market soon turned lower, however, and at the close prompt metal was available at 7½ cents. With a likelihood of a quieting down of civil warfare in China offerings from that country were on a larger scale recently. Buyers were not so eager to bid and former limits were either withdrawn or lowered. Stocks here were firmly held and the position in China was steady. Shipments from Far East quote 5½ cents c. i. f. New York. Shipments of Chinese regulars to this country for the first eight months of this year are reported at 3,810 tons as compared with 5,567 tons during the same period in 1929.

QUICKSILVER

There was a sharp reduction in price of quicksilver during September. A restricted demand apparently led to current low prices though some holders reported fairly good buying. Offerings were ample and prices quoted from \$110 to \$116 a flask of 70 pounds. Inside quotations applied to good sized quantities.

PLATINUM

The position of this metal has been easy lately with certain factors ready to dispose of material at concessions. Supplies have been coming on the market for account of Russia and the Transvaal. Refined quotes \$33 to \$34 per ounce. In some quarters lower prices are expected as new production becomes available.

SILVER

The silver market remains a comparatively uneventful affair. Price, however, has held up better during recent weeks and at current quotation of 36½ cents per ounce is several points above the low of a few months ago. China was a more active buyer and gave considerable support to the situation. Offerings have been limited and these were readily absorbed by the Far East demand. India for the time being appears to take little active part in the market. A new outlet for the world oversupply of silver has been proposed by several of the leading nations advancing to China a loan of 500,000,000 ounces of silver in an effort to build up China's credit and make the Orient a good customer for the products of this country and Europe. This would require the joint action of all the powerful nations, but there is no evidence that the proposal is being considered as a feasible expedient.

OLD METALS

Following weak conditions in the market for new copper the scrap grades have naturally reflected the decline for electrolytic. Reductions in eastern markets and in the Middle West were quoted in the last half of September though concessions were made reluctantly in view of the abnormally low levels previously established. The buying movement, however, has been curtailed by the unsettled conditions due to downward tendency of prices and cautious attitude of both sellers and buyers. Some factors in the business have never witnessed prices as low as at present and in some quarters the opinion is entertained that prices have struck bottom. New York dealers quote buying prices at 8¾c to 9c for strictly high grade crucible copper, 8c to 8¼c for ordinary heavy copper, 7½c to 7¾c for light copper, 6½c to 6¾c for new brass clippings, 4¾c to 5c for heavy brass, 4c to 4¼c for heavy lead, 3¾c to 4c for light brass, and 13c to 13½c for aluminum clippings.

Daily Metal Prices for Month of September, 1930

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	1*	2	3	4	5	8	9	10	11	12	15	16
Copper c/lb. Duty Free												
Lake (Del.)	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	10.75	10.75
Electrolytic (f. a. s. N. Y.)	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	10.95	10.75	10.75
Casting (f. o. b. refinery)	10.75	10.75	10.625	10.625	10.625	10.625	10.625	10.625	10.625	10.50	10.25	10.25
Zinc (f. o. b. St. L.) c/lb. Duty 1¼c/lb.												
Prime Western	4.35	4.30	4.35	4.30	4.30	4.30	4.30	4.30	4.275	4.275	4.275	4.30
Brass Special	4.40	4.35	4.40	4.35	4.35	4.35	4.35	4.35	4.325	4.325	4.325	4.35
Tin (f. o. b. N. Y.) c/lb. Duty Free												
Straits	29.80	29.75	29.65	29.70	29.80	29.85	29.90	30.00	29.875	29.875	29.875	29.90
Pig 99%	29.30	29.25	29.15	29.20	29.30	29.35	29.40	29.50	29.375	29.375	29.375	29.25
Lead (f. o. b. St. L.) c/lb. Duty 2¼c/lb.	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35
Aluminum c/lb. Duty 4c/lb.	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30
Nickel c/lb. Duty 3c/lb.												
Ingot	35	35	35	35	35	35	35	35	35	35	35	35
Shot	36	36	36	36	36	36	36	36	36	36	36	36
Electrolytic	35	35	35	35	35	35	35	35	35	35	35	35
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	7.875	7.875	8.00	8.00	8.00	7.875	7.875	7.875	7.875	7.75	7.75	7.75
Silver c/oz. Troy Duty Free	35.75	35.50	36.00	36.125	36.125	36.25	36.25	36.25	36.00	36.625	36.25	36.375
Platinum \$/oz. Troy Duty Free	35.00	35.00	35.00	31.00	31.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
	17	18	19	22	23	24	25	26	29	30	High	Low
Copper c/lb. Duty Free												
Lake (Del.)	10.75	10.75	10.625	10.625	10.625	10.625	10.625	10.625	10.125	10.125	11.00	10.125
Electrolytic (f. a. s. N. Y.)	10.75	10.75	10.50	10.50	10.50	10.50	10.50	10.50	10.00	10.00	11.00	10.00
Casting (f. o. b. refinery)	10.25	10.25	10.25	10.25	10.25	10.125	10.125	10.125	9.75	9.75	10.75	9.75
Zinc (f. o. b. St. L.) c/lb. Duty 1¼c/lb.	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.35	4.25
Prime Western	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.40	4.30
Brass Special	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.40	4.30
Tin (f. o. b. N. Y.) c/lb. Duty Free												
Straits	29.85	29.80	29.65	29.25	29.80	29.75	29.55	29.15	28.75	28.70	30.00	28.70
Pig 99%	29.25	29.125	29.00	28.75	29.25	29.25	29.00	28.625	28.25	28.10	29.50	28.10
Lead (f. o. b. St. L.) c/lb. Duty 2¼c/lb.	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35
Aluminum c/lb. Duty 4c/lb.	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30
Nickel c/lb. Duty 3c/lb.												
Ingot	35	35	35	35	35	35	35	35	35	35	35	35
Shot	36	36	36	36	36	36	36	36	36	36	36	36
Electrolytic	35	35	35	35	35	35	35	35	35	35	35	35
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	7.75	7.75	7.70	7.625	7.625	7.625	7.625	7.625	7.625	7.50	8.00	7.50
Silver c/oz. Troy Duty Free	36.875	37.00	36.75	36.875	36.875	36.75	36.625	36.50	35.875	35.50	37.00	35.70
Platinum \$/oz. Troy Duty Free	30.00	30.00	29.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	35.00	29.00

*Holiday.

Metal Prices, October 6, 1930

NEW METALS

Copper: Lake 10.125. Electrolytic, 10.00. Casting, 9.75.
Zinc: Prime Western, 4.225. Brass Special, 4.325.
Tin: Straits, 28.00. Pig, 99%, 27.30.
Lead: 5.10. Aluminum, 23.30. Antimony, 7.50.

Nickel: Ingot, 35. Shot, 36. Elec., 35. Pellets, 40.
Quicksilver: flask, 75 lbs., \$112.50. Bismuth, \$1.00.
Cadmium, 70. Cobalt, 97%, \$2.50. Silver, oz., Troy (N. Y.
official price October 6), 35.75.
Gold: oz., Troy, \$20.67. Platinum, oz., Troy, \$33.00.

INGOT METALS AND ALLOYS

Brass Ingots, Yellow.....	8 to 9½
Brass Ingots, Red.....	10¾ to 12
Bronze Ingots	11½ to 13½
Casting Aluminum Alloys.....	21 to 24
Manganese Bronze Castings	22 to 37
Manganese Bronze Ingots	10 to 12
Manganese Bronze Forgings	35 to 43
Manganese Copper, 30%.....	23 to 30
Monel Metal Shot	28
Monel Metal Blocks	28
Parsons Manganese Bronze Ingots	16½ to 19¾
Phosphor Bronze	12 to 14
Phosphor Copper, guaranteed 15%	15 to 16½
Phosphor Copper, guaranteed 10%.....	14 to 15½
Phosphor Tin, no guarantee.....	36 to 42
Silicon Copper, 10%, according to quantity	25 to 35

OLD METALS

Buying Prices		Selling Prices	
8.75 to 9.00	Strictly Crucible Copper	9.75 to 10.00	
8.00 to 8.50	Heavy Copper and Wire	9.00 to 9.25	
7.50 to 7.75	Light Copper	8.50 to 8.75	
4.75 to 5.00	Heavy Brass	5.75 to 6.00	
3.25 to 4.00	Light Brass	4.25 to 5.00	
7.50 to 7.75	No. 1 Composition	8.50 to 8.75	
6.75 to 7.00	New Composition Turnings	7.75 to 8.00	
4.00 to 4.25	Heavy Lead	5.00 to 5.25	
2.00 to 2.125	Old Zinc	3.00 to 3.125	
2.75 to 3.00	New Zinc Clips	3.75 to 4.00	
13.00 to 13.50	Aluminum Clips (new)	16.75 to 17.75	
8.00 to 8.25	Scrap Aluminum, cast alloyed.....	11.25 to 13.25	
8.25 to 8.75	Scrap Aluminum sheet (old)	10.00 to 11.00	
17 to 18	No. 1 Pewter	21 to 22	
19.50 to 20.50	Old Nickel Anodes	21.50 to 22.50	
14 to 22	Old Nickel	16 to 24	

Wrought Metals and Alloys

COPPER SHEET

Mill shipment (hot rolled) 19¾c. to 20¾c. net base
Front Stock 20¾c. to 21¾c. net base

BARE COPPER WIRE

11¾c. to 12c. net base, in carload lots.

COPPER SEAMLESS TUBING

22¾c. to 23¾c. net base.

SOLDERING COPPERS

300 lbs. and over in one order 18¾c. net base
100 lbs. to 300 lbs. in one order 18¾c. net base

ZINC SHEET

Duty on sheet, 2c. per lb. Cents per lb.
Carload lots, standard sizes and gauges, at mill, less Net Base
7 per cent discount..... 9.50
Casks, jobbers' price..... 9.75
Open casks, jobbers' price..... 10.50 to 10.75

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga., base, ton lots, per lb. 32.30
Aluminum coils, 24 ga., base price 30.00

ROLLED NICKEL SHEET AND ROD

Net Base Prices
Cold Drawn Rods..... 50c. Cold Rolled Sheet..... 60c.
Hot Rolled Rods..... 45c. Full Finished Sheet..... 52c.

BLOCK TIN SHEET

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge
or thicker, 100 lbs. or more 12c. over N. Y. Pig Tin; 50 to 100
lbs., 18c. over; 25 to 50 lbs., 20c. over; less than 25 lbs., 25c. over.

SILVER SHEET

Rolled sterling silver (October 6) 38.50c. Troy oz., up-
ward according to quantity.

BRASS MATERIAL—MILL SHIPMENTS

In effect September 30, 1930
To customers who buy 5,000 lbs. or more in one order

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	\$0.17	\$0.18½	\$0.19¼
Wire .....	.17½	.18½	.19¾
Rod .....	.15¼	.18½	.19¾
Brazed tubing .....	.24½	.....	.28¾
Open seam tubing .....	.25	.....	.27¼
Angles and channels .....	.25	.....	.27¼

BRASS SEAMLESS TUBING

21¾c. to 22¾c. net base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod 18¾c. net base
Muntz or Yellow Metal Sheathing (14"x48")... 19c. net base
Muntz or Yellow Rectangular sheet other sheath-
ing 19c. net base
Muntz or Yellow Metal Rod..... 16¾c. net base
Above are for 100 lbs. or more in one order.

NICKEL SILVER (NICKELENE)

Net Base Prices			
Grade "A" Sheet Metal		Wire and Rod	
10% Quality	24¾c.	10% Quality	27¾c.
15% Quality	26¾c.	15% Quality	31¾c.
18% Quality	28¾c.	18% Quality	35¾c.

MONEL METAL, SHEET AND ROD

Hot Rolled Rods (base) 35 Full Finished Sheets (base) 42
Cold Drawn Rods (base) 40 Cold Rolled Sheets (base) 50

BRITANNIA METAL SHEET

No. 1 Britannia—18" wide or less, No. 26 B. & S. Gauge or
thicker, 500 lbs. or over, 10c. over N. Y. tin price; 100 lbs. to
500 lbs., 12c. over; 50 to 100 lbs., 18c. over; 25 to 50 lbs., 20c.
over; less than 25 lbs., 25c. over. Prices F. O. B. mill.

Supply Prices, October 6, 1930

ANODES

Copper: Cast	25 3/4c. per lb.	Nickel: 90-92%	45c. per lb.
Rolled, oval	22 1/8c. per lb.	95-97%	47c. per lb.
Rolled, sheets, trimmed	22 1/4c. per lb.	99%	49c. per lb.
Brass: Cast	24 3/4c. per lb.	Silver: Rolled silver anodes .999 fine were quoted October 6	
Zinc: Cast	11 3/4c. per lb.	from 38.75, per Troy ounce upward, depending upon quantity.	

FELT POLISHING WHEELS WHITE SPANISH

Diameter	Thickness	Under 100 lbs.	100 to 200 lbs.	Over 200 lbs.
10-12-14 & 16"	1" to 3"	\$3.00/lb.	\$2.75/lb.	\$2.65/lb.
6-8 & Over 16	1 to 3	3.10	2.85	2.75
6 to 24	Under 1/2	4.25	4.00	3.90
6 to 24	1/2 to 1	4.00	3.75	3.65
6 to 24	Over 3	3.40	3.15	3.05
4 up to 6	1/4 to 3	4.85	4.85	4.85
4 up to 6	Over 3	5.25	5.25	5.25
Under 4	1/4 to 3	5.45	5.45	5.45
Under 4	Over 3	5.85	5.85	5.85

Grey Mexican Wheel deduct 10c per lb. from White Spanish prices.

COTTON BUFFS

Full Disc Opens buffs, per 100 sections.	
11" 20 ply 64/68 Unbleached	\$20.94 to 26.85
14" 20 ply 64/68 Unbleached	31.09 to 39.86
11" 20 ply 80/92 Unbleached	24.39 to 31.27
14" 20 ply 80/92 Unbleached	35.94 to 46.07
11" 20 ply 84/92 Unbleached	26.85 to 38.34
14" 20 ply 84/92 Unbleached	39.88 to 56.89
11" 20 ply 80/84 Unbleached	31.38 to 40.23
14" 20 ply 80/84 Unbleached	46.53 to 59.64
Sewed Pieced Buffs, per lb., bleached	33c. to 79c.

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.11-.18	Lacquer Solvents	gal.	.85
Acid—Boric (Boracic) Crystals	lb.	.07 3/4	Lead Acetate (Sugar of Lead)	lb.	.13 1/4
Chromic, 75 to 400 lb. drums	lb.	.16 1/2-.20	Yellow Oxide (Litharge)	lb.	.12 1/2
Hydrochloric (Muriatic) Tech., 20 deg., carboys	lb.	.02	Mercury Bichloride (Corrosive Sublimate)	lb.	\$1.58
Hydrochloric, C. P., 20 deg., carboys	lb.	.06	Nickel—Carbonate, dry bbls.	lb.	.35
Hydrofluoric, 30%, bbls.	lb.	.08	Chloride, bbls.	lb.	.20-.21 1/2
Nitric, 36 deg., carboys	lb.	.06	Salts, single, 300 lb. bbls.	lb.	.12 1/4-.13
Nitric, 42 deg., carboys	lb.	.07	Salts, double, 425 lb. bbls.	lb.	.12 1/4-.13
Sulphuric, 66 deg., carboys	lb.	.02	Paraffin	lb.	.05-.06
Alcohol—Butyl	lb.	.16 1/4-.21 1/4	Phosphorus—Duty free, according to quantity	lb.	.35-.40
Denatured, drums	gal.	.42-.60	Potash Caustic Electrolytic 88-92% broken, drums	lb.	.083
Alum—Lump, barrels	lb.	.03 1/4-.04	Potassium Bichromate, casks (crystals)	lb.	.09 1/4
Powdered, barrels	lb.	.04	Carbonate, 96-98%	lb.	.06 1/4-.07
Ammonium chloride, solution in carboys	lb.	.06 1/4	Cyanide, 165 lb. cases, 94-96%	lb.	.57 1/2
Ammonium—sulphate, tech., bbls.	lb.	3.3	Pumice, ground, bbls.	lb.	.02 1/4
Sulphocyanide	lb.	.65	Quartz, powdered	ton	\$30.00
Arsenic, white, kegs	lb.	.05	Rosin, bbls.	lb.	.04 1/2
Asphaltum	lb.	.35	Rouge, nickel, 100 lb. lots	lb.	.25
Benzol, pure	gal.	.58	Silver and Gold	lb.	.65
Borax Crystals (Sodium Biborate), bbls.	lb.	.04 1/2	Sal Ammoniac (Ammonium Chloride) in casks	lb.	.05 1/2
Calcium Carbonate (Precipitated Chalk)	lb.	.04	Silver Chloride, dry, 100 oz. lots	oz.	.29 1/4
Carbon Bisulphide, Drums	lb.	.06	Cyanide (fluctuating)	oz.	.42-.47 1/2
Chrome Green, bbls.	lb.	.24	Nitrate, 100 ounce lots	oz.	.26
Chromic Sulphate	lb.	.30-.40	Soda Ash, 58%, bbls.	lb.	.02 1/2
Copper—Acetate (Verdigris)	lb.	.23	Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.17
Carbonate, bbls.	lb.	.17 1/2	Hyposulphite, kegs	lb.	.04
Cyanide (100 lb. kgs)	lb.	.45	Nitrate, tech., bbls.	lb.	.04 1/4
Sulphate, bbls.	lb.	.495	Phosphate, tech., bbls.	lb.	.03 1/4
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.27	Silicate (Water Glass), bbls.	lb.	.02
Crocus	lb.	.15	Sulpho Cyanide	lb.	.32 1/2-.42 1/2
Dextrin	lb.	.05-.08	Sulphur (Brimstone), bbls.	lb.	.02
Emery Flour	lb.	.06	Tin Chloride, 100 lb. kegs	lb.	.32
Flint, powdered	ton	\$30.00	Tripoli, Powdered	lb.	.03
Fluor-spar (Calcic fluoride)	ton	\$70.00	Wax—Bees, white, ref. bleached	lb.	.60
Fusel Oil	gal.	\$4.45	Yellow, No. 1	lb.	.45
Gold Chloride	oz.	\$12.00	Whiting, Bolted	lb.	.02 1/2-.06
Gum—Sandarac	lb.	.26	Zinc, Carbonate, bbls.	lb.	.11
Shellac	lb.	.59-.61	Chloride, casks	lb.	.06 1/4
Iron Sulphate (Copperas), bbl.	lb.	.01 1/2	Cyanide (100 lb. kegs)	lb.	.41
			Sulphate, bbls.	lb.	.03 1/2